© 2011 Lian J. Ruan

INFORMATION-SEEKING AND SHARING BEHAVIORS AMONG FIRE SERVICE FIELD STAFF INSTRUCTORS: A QUALITATIVE STUDY

BY

LIAN J. RUAN

DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Library and Information Science
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2011

Urbana, Illinois

Doctoral Committee:

Professor Linda C. Smith, Chair
Professor Carole L. Palmer, Director of Research
Professor Caroline Haythornthwaite
Professor Marshall Scott Poole

ABSTRACT

Fire service field staff instructors seek and share information and use information sources during their instructional work of teaching, training and curriculum development. This study is the first attempt to study their information-seeking and sharing behaviors, which have not previously been investigated empirically. Twenty-five fire service instructors who are field staff instructors of the Fire Academy were recruited to participate in the study. Semi-structured interviews as primary data along with secondary data were employed and examined to answer the research questions.

Today's firefighters' responsibilities cover a wide range of emergencies in areas such as firefighting, emergency medical care, hazardous materials incidents, rescue operations, terrorism and other emergency responses. The increasing complexity of the fire service requires firefighters to continually hone their skills and improve their knowledge of various hazards through training. This study's findings reveal that the field staff instructor participants rely extensively on multiple types of information sources, while seeking and sharing information during the instructional process. These sources include formal/institutional, informal/personal and group network-mediated sources of information. This study identifies three collaborative information-seeking forms of joint, tag team, and intra-group and categorizes sequences of information activities the instructor participants undertake. It also characterizes their unique attributes as information seekers. Fire service knowledge structures of KSA -- (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) -- influence the changing needs of instructor participants, define the boundaries of information sources in these three required domain areas that firefighters learn and train, and dictate multiple types of information sources that are used and needed by the instructor participants. The dynamic nature and uncertainty of

the fire service business as well as the task complexity are basic catalysts for the instructor participants' information-seeking and sharing behaviors, which motivate them to keep seeking the best piece of information to ensure the safety of firefighters. The Recognition-Primed Decision model leads instructor participants toward a heavy reliance on experiential knowledge. Furthermore, the selection of information sources is determined by the quality of the source, and multiple types of sources of information are constantly integrated to meet the field staff instructors' constantly changing needs. Armed with new evidence, this study revises and expands Leckie's model of information-seeking of professionals.

This study recognizes the critical roles of field staff instructors in fire service training as they create, retain and share knowledge, skills and experience. The study also conceptualizes their multi-dimensional information environment with a cyclical and interactive information-seeking process that would best support their work activities. It makes suggestions for future research and lays out recommendations to improve library and information services, so fire librarians and information professionals can better provide more timely services to support fire service field staff instructors' information-seeking and sharing in a complex information use environment for their daily work, practices, and routines.

To fire service field staff instructors, unsung heroes

ACKNOWLEDGMENTS

This research project would never have been conducted and completed without the support of many people. Sincerest appreciation and thanks go to my committee members for their generous support along the way. I want to express special thanks to my dissertation committee chair, Professor Linda C. Smith, for her ongoing direction and timely support whenever I need it. Her thoughtful understanding always gives me strength. To Professor Carole L. Palmer, my advisor and director of research, for her strategic guidance, strict scholarly standards, and full support from my very first day in the doctoral program, and for allowing me to aim high and reminding me to remain focused. Her accomplished work in use and users of information has had a direct impact on my research, especially this research project. Over the course of my time in the program, I have learned tremendously from enrolling in her courses and exploring various, but related, ideas on the information-seeking of professionals. Some of those ideas have formed the core elements of this study. To Professors Caroline Haythornthwaite and Marshall Scott Poole, for their invaluable advice, candid comments, informative insights, and believing in me. My special thanks to the Graduate School of Library and Information Science (GSLIS), University of Illinois at Urbana-Champaign for providing me financial support from the Ernest Reece Fund for Library Research to help with my data transcription and to keep me on schedule.

Profound gratitude goes to my colleagues at work, especially Director Richard L. Jaehne for his high expectations and strong administrative support. His visionary leadership and value-added and proactive approach have deeply influenced and driven me. I appreciate that he granted me the professional opportunity to tackle information-related issues in the fire service field. To Deputy Director David Clark, for sharing with me his enormous knowledge and passion about the fire service. My special thanks also go to my library staff -- Diane Richardson, Adam Groves and the library student assistants -- for their assistance and patience throughout the project. All of them mean a lot to me, and I treasure them in my heart.

Particular appreciation goes to Professor Pauline Atherton Cochrane, my guiding light, for standing by me unselfishly all those years and for lifting me up so I could reach my dreams. Her user-centered philosophy has fundamentally influenced my career goals and changed the way I have managed and led the library. To Professors Jesse Delia and William Jones, my mentors, for their support and encouragement. I am extremely grateful for the opportunity to get to know them and always feel so lucky to grow professionally under their care and attention. To Dean John M. Unsworth, for his leadership and support of doctoral students like me.

There are many bright GSLIS doctoral students who lend their hands whenever I ask and energize me as the journey becomes challenging. Among them, to name a few, they are Timothy P. Hogan, Melissa H. Cragin, Paul Healey, Hong Zhang, Xiao Hu, and Wei Li.

Certainly, I owe my deepest sense of debt to my parents, husband and two boys for their unconditional love and countless sacrifices. They have always been there for me at every step of this long and demanding journey, regardless of up and down times.

Finally, to those fire service field staff instructors who participated in the study, it would be impossible for me to complete this project successfully without their enthusiastic involvement and support. I would like to dedicate this dissertation to all of them. I hope my research, which is just a beginning, will help scholars, librarians, information professionals and students to better understand their information behaviors, and innovative library programs and information services will be designed and implemented to meet their highly complicated and dynamic needs.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The first chapter of this study includes five sections: Objectives of the Study; Research Questions; Definitions of Information, Information-Seeking and Information Sharing; Taylor's Information Use Environments (IUE) Model; and Leckie's Model of Information-Seeking of Professionals. It also summarizes the chapters that follow.

1.1 OBJECTIVES OF THE STUDY

The study's objectives are three-fold:

1) On the empirical level, the study aims to discover and analyze fire service field staff instructors' information-seeking and sharing behaviors. The findings will help enhance library collection and information services to support their information sharing and collaboration in a complex information use environment of daily routines, such as training, teaching, curriculum development and actual incident response;

2) On the conceptual level, it aims to extend existing conceptual frameworks of information-seeking and sharing of professionals;

3) On the practical, operational and technological level, it will inform librarians and information professionals about the information-seeking and sharing behaviors among fire service field staff instructors, so they can be more responsive in key areas, such as information services, user training and collection development.

1.2 RESEARCH QUESTIONS

As fire service field staff instructors organize and perform instructional work (teaching, training, and developing curriculum), they seek and share information and use information sources. I examined the context in which individual field staff instructors conducted these training activities, collected examples of typical problems they encountered, identified information needs, and learned how they used information to resolve those problems and meet their needs. I also examined how teamwork affects their information-seeking and sharing behaviors, since the interactions with team members could be the means by which information was accessed, retrieved, and shared collectively, or how tasks were assigned to acquire needed information.

One purpose of this research was to conceptualize the type of information environment that would best support fire service field staff instructors' work practices. Building upon Taylor's (1991) Information Use Environments (IUE), the study used the empirical findings to revise and expand the general model of information-seeking of professionals created by Leckie, Pettigrew, and Sylvain (1996) as shown in Figure 1. Another purpose of the study was to develop a broader and deeper understanding of fire service field staff instructors' information-seeking and sharing behaviors, built upon the findings from previous studies, including my 2007 survey project, and to enlarge our understanding of the IUE of this group as they collaborated to perform their daily tasks. I further enriched the professional knowledge structures (Pierce, 1987) by examining fire service knowledge structures of KSA -- (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) -- with an information dimension.

The design of the study and the analysis of the data have been guided by the following research questions:

1) How do fire service instructors, in particular the Fire Academy's field staff instructors, organize, work and perform their training, teaching and curriculum development?

2) What views of the world and theory of work inform their instructional activities?

3) What are the typical problems that lead them to engage in information-seeking while they are involved in their training, teaching and curriculum development activities?

4) What kinds of information sources do they look for and where, to solve these information problems?

5) How does collaborative teamwork affect an individual field instructor's information-seeking behavior?

6) What obstacles do they perceive in the search for and use of necessary information during the course of their work?

I investigated these questions through a qualitative method. The study focused on fire service field staff instructors, especially selected Fire Academy field staff instructors, who are the core training force for the fire service in the state where they work. Twenty-five fire service field staff instructors from multiple local organizations involved with the Fire Academy's curriculum development project(s) were recruited to participate in the study. Within the following chapters, I refer to the fire service field staff instructors who participated in my study as "the instructor participant."

1.3 DEFINITIONS OF INFORMATION, INFORMATION-SEEKING AND INFORMATION SHARING

In the body of information science literature, information has been defined in different ways (Case, 2007). Barr and Feigenbaum (1981) defined information from a problem-solving point of view built on expert systems development. They classified information into three categories -- domain information (e.g. known scientific facts), problem information (i.e. the problem characteristics), and problem-solving information (i.e. expertise in problem treatment). I adopt this viewpoint because it is relevant to this study, since the instructor participants used information to obtain cognitive knowledge and deal with practical problems.

Information-seeking is an important contemporary issue to study in information science. Bates pointed out that the central research question to ask is how human beings relate to human-produced information -- how they look for it, use it, disregard it, and retrieve it (Bates, 1999). Case (2007) argued that researchers rarely define "information-seeking" clearly. "When it is defined, it is described as a reaction to the recognition of an information need" (Case, 2007, p. 82). Several definitions were found in the literature. For example, Marchionini (1995) defined information-seeking as a problem-solving oriented process to change the seeker's state of knowledge. Choo, Detlor, and Turnbull (2000) suggested that information-seeking is a purposive and goal-directed problem-solving or decision-making process. Others regarded information-seeking as purposive seeking of information to meet an information need (Xu, Tan, & Yang, 2006) and critical to problem-solving (O'Reilly, 1982; Vancouver & Morrison, 1995). Those definitions focusing on problem-solving relate to Taylor's IUE (see Section 1.4) and are relevant to my study, since the instructor participants' information-seeking and sharing is tailored to problem-solving.

Researchers have increasingly acknowledged that individuals in collaborative work and learning environments undertake information behaviors as well (Foster, 2006). Talja & Hansen (2006) defined collaborative information behavior as "an activity where two or more actors communicate to identify information for accomplishing a task or solving a problem" (p. 114). They suggested that collaborative information behavior may cover both "collaborative information-seeking and retrieval," which emphasizes obtaining new information, and "information sharing," which involves communicating information that has already been acquired (p. 114). Hertzum (2008) held a similar point of view and proposed that models of collaborative information behavior should reflect on both information-seeking and sharing within groups. In my study, I considered collaborative information-seeking and sharing in this research, as well as activities that focus both on documents and people (Hansen & Järvelin, 2005).

1.4 TAYLOR'S INFORMATION USE ENVIRONMENTS (IUE) MODEL

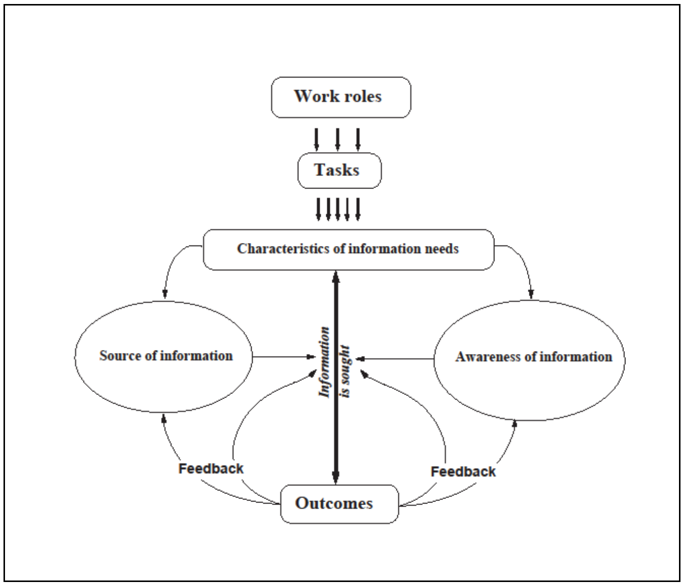
Taylor described information use environments (IUE) as a context or setting within which people live and work and where they "make choices about what information is useful to them at particular times" (Taylor, 1991, p. 218). It is the "set of those elements that (a) affect the flow and use of information messages into, within, and out of any definable entity; and (b) determine the criteria by which the value of information messages will be judged" (Taylor, 1986, p. 25-26). IUE has four categories: a) sets of people; b) typical structure and thrust of problems typically experienced by these sets of people; c) typical settings; and d) what constitutes problem resolution for typical problems (Taylor, 1991). My study utilized the IUE model to ground my original approach to investigating the instructor participants' information environment in their instructional work. The IUE model served as the framework for eliciting information about the instructor participants, their work setting, typical problems, and problem resolution.

1.5 LECKIE'S MODEL OF INFORMATION-SEEKING OF PROFESSIONALS

Leckie, Pettigrew, and Sylvain (1996) examined three professional groups' (engineers, health care workers and lawyers) information habits and practices, and found common characteristics among them. Built on the themes and patterns found in empirical studies, they proposed an original model of information-seeking processes to capture the complexity of professionals' information-seeking activities. They claimed that the model would be applicable to any professional working in any field. It is the only general model associated with professional groups that I have come across in the literature.

Leckie's model emphasizes that the roles and associated tasks performed by professionals in the course of daily practices provoke particular information needs, which in turn begin an information-seeking process (Leckie, Pettigrew, & Sylvain, 1996). "Given that the Leckie model is restricted to 'professionals'…, it is not surprising that 'work roles' and 'tasks' are thought to be the prime motivators for seeking" (Case, 2007, p. 127). Kwasitsu (2003) and Vakkari (2003) endorsed tasks and roles as the primary impetus for work-related information practices, as did others (Belkin, Oddy, & Brooks, 1982; Ingwersen, 1992; Mick, Lindsey, & Callahan, 1980). As shown in Figure 1, the six components of the model include: 1) Work roles (service provider, administrator/manager, researcher, educator, teacher and student); 2) Associated tasks (specific tasks, for example, counseling, report writing, etc.); 3) Characteristics of information needs (variables/factors that direct or form the information needs of professionals, such as individual demographics, status in the organization, years of experience, area of specialization, context, complexity, acting as a filter in the process, etc.); 4) Sources of information (types of channels or formats: internal/external, oral/written, and personal); 5) Awareness of information (direct or indirect knowledge of various information sources, familiarity, trustworthiness, timeliness, quality, accessibility, etc.); 6) Outcomes (which include the positive results of the process and a feedback loop which drives the next round of information-seeking). Any of the components of the model can occur concurrently to illustrate the complexity of a professional's work life (Leckie, Pettigrew, & Sylvain, 1996).

Figure 1. Leckie's Model of Information-Seeking of Professionals (Leckie, Pettigrew, & Sylvain, 1996, p. 180)



As Leckie's model indicates, once the information-seeking process has originated, two interacting factors – sources of information (all potential sources of information available) and awareness of information (an individual's knowledge about those sources and their likely usefulness) – become critical in the success of the seeking process. The selection of an information source can combine several sources (either concurrently or in sequence) to satisfy an information need (Leckie, Pettigrew, & Sylvain, 1996). Both factors develop the dynamic nature of information-seeking activities and outcomes. At the finishing point, outcomes are the result of the information-seeking process. A "feedback" loop indicates that information-seeking may resume until the need has been filled. Leckie, Pettigrew, and Sylvain (1996) implied that the feedback loop only looped back as far as the characteristics of the information need. However, some researchers pointed out that the looping could go back further to the task and work roles to redefine the information need, task, or role, and a new information-seeking process may be stimulated with different combinations of sources and awareness factors (Yitzhaki & Hammershlag, 2004).

Leckie, Pettigrew, and Sylvain (1996) made an attempt to advance the theoretical discussion of information-seeking as a process. They argued that information-seeking and information-related practices are more similar across diverse professions than had been previously thought. The model has been cited since its publication (Bin, 2009; Bronstein & Baruchson-Arbib, 2008; Du Preez, 2008; Kari, 2009; Leckie, 2005; Savolainen, 2008) although I did not find any significant expansion upon it. For example, Leckie and Pettigrew (1997) used the model to analyze data from a study of the role of visiting nurses in linking the elderly with community resources. Wilkinson (2001) attempted to test and refine the model in her study of lawyers' information-seeking processes. To enhance the model for lawyer participants, she proposed to make the organizational context and the demographic characteristics of the user more explicit and more directly linked to awareness of information and selection of sources. Baker (2004) used the model as the framework for understanding female police officers' needs within the context of their role as decoys. The female police officers' work demands the use of several methods of informal communication, including signals and dress code. Baker observed that informal information giving is not explicitly addressed in the model and argued that the model is too formal and reflected more traditional types of work in an institutional setting.

Based on findings from my 2007 survey project, and the studies by Leckie & Pettigrew (1997), Wilkinson (2001), and Baker (2004), the Leckie model has provided fruitful grounding and a useful theoretical framework for analyzing the instructor participants' information behaviors. My study design reconciled the two existing models of information behaviors of professionals --Taylor's IUE model and Leckie's model -- to study the instructor participants' information-seeking and sharing behaviors. A third model, Recognition-Primed Decision (RPD) by Klein (1988), was also introduced to assess its role in the instructor participants' information behaviors (see Figure 2 in Chapter 2). The RPD model has contributed to instructor participants' instructional work, and it is especially related to sources of information of the Leckie model.

In the following chapters, I situate the study by describing fire service training, firefighters, fire service knowledge structures, the Fire Academy and field staff instructors in Chapter 2. I then review the literature on relevant topics in Chapter 3, cover the research methods applied in data collection and analysis in Chapter 4, and report the major empirical findings in chapters 5 through 8, followed by my revision and expansion of Leckie's model of information-seeking of professionals in Chapter 9. Finally, in Chapter 10, I revisit the key findings that have emerged from this study and conclude with a discussion of the contributions, implications and limitations of this study, and with suggestions for future research.

CHAPTER 2

CONTEXT OF THE STUDY

This chapter serves as background to the study and introduces the working context of fire service field staff instructors, which includes a fast-paced work setting, a complex and high risk occupation, a unique culture, naturalistic decision-making, fire service knowledge structures, and related characteristics of fire service training. Information-seeking and sharing behaviors among field staff instructors are situated in the context of these activities. The organizational, social and cultural structures in which field staff instructors undertake their work are part of their information-seeking and use processes.

Taylor (1991) proposed that the information use environments (IUE) in which a group functions direct that group's information behaviors. As demonstrated in previous research of information-seeking behavior, one must first have knowledge about the organization, goals and tasks of that population in order to develop a profound understanding of a target population's information-seeking behavior in context. Wilson and Streatfield (1977) suggested in their study of a government department that the broader working context in which professional practice is conducted must be closely examined to understand the information-seeking behaviors of professionals. My literature review in Chapter 3 provides evidence that supports how different working contexts directly lead to different information-seeking behaviors.

2.1 FIRE SERVICE AND FIREFIGHTERS

Fire is a central national problem in the United States (Combs, 2008; United States. National Commission on Fire Prevention and Control, 1973). The country continues to suffer the greatest loss from fire among all industrialized nations in the world (Angle et al., 2008; Hall & Karter, 2004). There are more than 30,000 fire departments and over a million firefighters nationwide (Angle et al., 2008). A fire department's main duties are to perform life safety, stabilize incidents and undertake property conservation (Dennis, 2000). The fire protection responsibilities have remained local (Smeby, 2006).

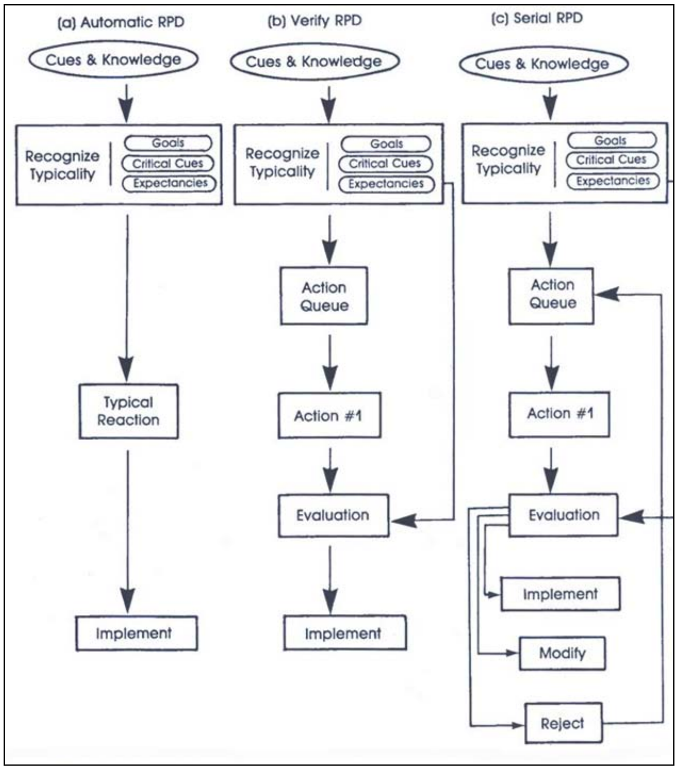
The characteristics of the fire service in the state I studied reflect that of the fire service in other parts of the nation. To protect their local community, firefighters respond to emergencies and save lives (Bureau of Labor Statistics, United States. Department of Labor, 2010). State estimates show that there are 1,293 fire departments, 42,675 firefighters (8,600 officers, 13,300 paid) and approximately 2,000 fire service instructors. Only 6% of all fire departments are paid; the rest are volunteer, paid-on-call, or are a combination of volunteer, paid-on-call and paid, according to the Office of the State Fire Marshal.

The fire service culture arises from the unique nature of the work environment (Frazier et al., 2003; Thiel, 1999), emphasizing companionship, fraternity, and teamwork (Kirschman, 2004). For firefighters, the fire service is regarded as their second family, since most of their duties and activities center around the firehouse. A typical firefighter's workday schedule during a 24-hour shift in a firehouse is shown in Appendix A. Firefighters live and work together under high stress and hazards for extended periods, and they often relax on and off duty together (International Fire Service Training Association, 1998; Kennedy, 1996; Kirschman, 2004; Orr, 2003). There is a strong family tradition of being a firefighter that can go back a number of generations (Wallington, 2003, p. 95). There is also a strong team culture. Firefighters must operate effectively and safely in teams to ensure successful emergency response (Pressler, 1994, 1999; Shapiro, 2004; Sitz, 2005). Emergency operation skills become more critical when many of the tasks must be completed by a team of people (Wallington, 2003, p. 118).

Firefighters depend on their equipment for safety and to complete their work. A firefighter's equipment includes power and hand tools, a self-contained breathing apparatus, personal protective equipment (PPE), electronic instruments, etc. (Dodson, 2004b; Fritz, 1997). With PPE, for example, firefighters are able to perform search-and-rescue operations or conduct fire suppression activities (International Association of Fire Chiefs & National Fire Protection Association, 2006). Portable radios are considered a critical item of personal protective equipment on the fireground (Furey, 2002a, 2002b, 2002c; McKeever, 1997; Meister, 1997, 1998; Varone, 2003). Although technology has advanced this culture of equipment, many tools used hundreds of years ago are still in use today (Fritz, 1997; Wallington, 2003).

The fire service is unique in its decision-making process and has characteristics of naturalistic decision-making (NDM). Klein and Klinger (1991) defined NDM as an attempt to understand how humans make decisions in complex real-world situations under factors like time, stress, and uncertainty. They found that experienced decision makers emphasized acting rather than analyzing (see also Klein, 1988, 1989; Norling & Heinze, 2000; Zsambok, 1997; Zsambok, Beach, & Klein, 1992; Zsambok & Klein, 1997). For the fireground task environment, Klein's research findings (1989) revealed that "recognitional" strategies were highly efficient, while analytical methods were hardly applied. The recognitional strategies were regarded as a Recognition-Primed Decision (RPD) model (Klein, 1993, Klein, Calderwood & Clinton-Cirocco, 1986; Klein et al., 1993; Klein & Klinger, 1991), which is illustrated in Figure 2 (Klein, 1988, p. 88). Klein and Klinger (1991) further indicated that RPD involved non-optimizing and non-compensatory strategies and required little conscious deliberation. The fire service's repetition of training helps firefighters reach these "recognitional" matches in emergency response through learning the critical cues for handling a specific incident type. RPD develops for firefighters the critical mindset that everything is action (National Fire Academy, 2000). The RPD model, especially automatic RPD, has served as the goal of field staff instructors' instructional activities (Fire Academy Deputy Director, personal communication, August 8, 2008).

Figure 2. Recognition-Primed Decision Model (Klein, 1988, p. 88)



The modern firefighting profession is dangerous and high-risk since it involves the risk of death or injury (e.g., Bureau of Labor Statistics, United States, Department of Labor, 2008; Fahy & LeBlanc, 2004, 2005; National Institute for Occupational Safety and Health, 2002, 2010). For example, since 1857 more than 130 fire organizations have lost firefighters in the line of duty in one state. As of February 19, 2010, the Fire Academy Library documents that 832 firefighters have died in the line of duty (Fire Academy Archivist, personal communication, March 1, 2010). Research findings revealed that more firefighters die in structural fires today when compared to firefighter line of duty deaths from decades ago, when there was a lower number of structural fires (Kirschman, 2004; United States Fire Administration & TriData Corporation, 2002). There are approximately 100 firefighter line of duty deaths each year on average (Bureau of Labor Statistics, United States. Department of Labor, 2008). Recent research findings from fatality incidents concluded a strong need for educational and training programs in basic firefighting skills and procedures to ensure firefighter safety (Fahy, 2006; Fahy & LeBlanc, 2005; Fahy et al., 2009; National Institute for Occupational Safety and Health, 2010; Smith et al., 2008; United States Fire Administration, 2002; United States Fire Administration & National Fire Protection Association, 2002; United States Fire Administration, Department of Homeland Security & Federal Emergency Management Agency, 2008).

The fire service has gone through dramatic expansion and rapid growth over the past decades that require firefighters to be better educated and trained than in the past. Firefighters' responsibilities today cover a wide range of emergencies in areas such as firefighting, emergency medical care, hazardous materials incidents, rescue operations, natural disasters, biological, nuclear, incendiary, chemical and explosive terrorism, and other emergency responses (e.g., Angle et al., 2008; Bureau of Labor Statistics, United States. Department of Labor, 2008; Coleman, 2004; Onieal, 2003a, 2003b, 2003c, 2003d; Smeby, 2006; Sturtevant, 2001; Wallington, 2003). The job of contemporary firefighters is becoming increasingly complicated and challenging (Hall & Karter, 2004; Karter, 2005; Linstrom, 2006; Manning, 2002; National Fire Protection Association, 2003; Oniel, 2003a, 2003b, 2003c, 2003d; Salka & Neville, 2004; Smeby, 2006).

2.2 TRAINING IN THE FIRE SERVICE AND FIRE SERVICE KNOWLEDGE STRUCTURES

The classic report, titled "*America Burning*," by the National Commission on Fire Prevention and Control, brought a variety of fire issues to national attention, including the need for training in the fire service. It stated that better training would improve the effectiveness of fire departments and reduce firefighter injuries (United States. National Commission on Fire Prevention and Control, 1973, p. x). In the United States, local fire departments have their own diversified methods of public fire protection because the federal government has few federal regulations for fire service (Forsman, 2003; Smeby, 2006). Different states handle training differently in terms of the subject matter and depth of programs due to unique local problems and situations (Forsman, 2003).

During the September 11th terrorist attacks, the varying characteristics and terminology of local fire departments made it challenging for multi-organizations to operate and coordinate efficiently together at the scene of a major emergency (Smeby, 2006). Central differences were found in the areas of equipment, operation procedures, radio channels and interoperability (Cote, 2003; Frazier et al., 2003; Linstrom, 2006; Smeby, 2006; Thiel, 1999). Responding to the terrorist acts required firefighters to perform in an interagency and collaborative way within a unified command system, following principles of the National Incident Management System (NIMS). Unified training became a mandatory requirement. Standardized training and preparedness of firefighters became much more crucial than ever. Historically, critical incidents like the September 11th terrorist attacks, Hurricane Katrina and firefighter fatalities motivate and drive the process of standardization in fire service training, starting with the standardization of materials (such as codes and training curriculum), procedures, and processes.

Today's firefighters must keep up learning high-technology equipment, such as radios, thermal imaging devices and self-contained breathing apparatus, different product-specific foams, and increasingly complex internal fire protection systems (Angle et al., 2008; Kramer, 1995; Sturtevant, 2001; Wallington, 2003; Wutz, 2004). As equipment has become more complicated, formalized training and good judgment have become even more important than in the past (Angle et al., 2008; International Association of Fire Chiefs & National Fire Protection Association, 2006).

The fire service profession requires a high level of training because of the emergency nature of the service (Smeby, 2006, p. 106). Every emergency situation requires firefighters' knowledge, ability and skills to bring it to a safe conclusion (International Fire Service Training Association, 1990, 1999). Firefighters must work through different training stages, such as entry-level training, in-service training and special operations training to achieve professional status in the states where they are located (Bureau of Labor Statistics, United States. Department of Labor, 2008; Coleman, 2002; Edwards, 1994; Holiday, 2006; International Association of Fire Chiefs & National Fire Protection Association, 2006; Koonce, 2004; Wallington, 2003). National standards, such as those provided by the National Fire Protection Association (NFPA) (see Appendix B) are developed by fire service experts, oftentimes fire service instructors from local fire departments. NFPA standards are not mandatory for states but are adapted to develop certification standards for local training programs. And, even with standards in place, it is widely accepted that once a person enters the fire service, the training never ends (Dodson, 2004a, p. 114).

Three KSA classifications -- (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) -- regarding the types of learning involved in fire service training are recognized and applied (International Fire Service Training Association, 1990, p. 57). The cognitive domain contains learning objectives on knowledge ("know why" knowledge). The psychomotor domain focuses on motor skills objectives ("know how," procedural knowledge), such as manipulating a tool or moving the body to accomplish a task. The affective domain concerns learning objectives that focus on feeling and emotion (associated with "know who" knowledge), such as attitudes and appreciation of team members' teamwork (Bloom, Mesia, & Krathwohl, 1964). The psychomotor domain is the most commonly applied domain of learning in the fire service and endorses Klein's naturalistic decision-making and the RPD model shown in Figure 2. The learning is always based on activity and is progressive (International Fire Service Training Association, 1990, p. 67). Live, hands-on fire training through acting out scenarios and simulation helps firefighters retain skills and operate safely (Edmondson, 2003; Forsman, 2003; Holiday, 2006; Kirschman, 2004; Smeby, 2006; Sturtevant, 2001).

Two well-known types of learning in the literature are single-loop and double-loop learning (Argyris & Schön, 1974). Training methods used in the fire service appear to be more in line with single-loop learning, which emphasizes problem-solving in the present without examining the appropriateness of current learning behaviors (Senge, 1990). This method is concerned with the reuse and improvement of existing practices or solutions that have worked previously. It is invaluable in empowering quality performance through refinement and incremental improvement (Deng & Poole, 2008). This type of learning is also the basis of Klein's naturalistic decision-making and the RPD model shown in Figure 2.

Carter and Rausch (1999) developed a knowledge/skill profile for a firefighter in training and learning. The profile has a list of topics that defines the knowledge and skills -- or competencies -- required by a position or by a major segment/function of a position. I expanded Carter and Rausch's table by adding Affective (attitude) as shown in Table 1. Topics in each column do not correlate with each other and are only samples, rather than a complete list. After training sessions, a firefighter student will acquire new knowledge, skills, and attitudes about the goals of the training process. KSA are the core elements of the fire service knowledge structures. The more often knowledge is used, the better it is retained and the quicker it becomes automatic

(International Fire Service Training Association, 1999, p. 63), which is consistent with the RPD model as shown in Figure 2.

Table 1. Knowledge/Skill/Affective (KSA) Profile for Firefighters
(Adopted and expanded from Carter & Rausch, 1999, p. 416)

Knowledge **Cognitive Domain** ("know why" knowledge)		**Skills** **Psychomotor Domain** ("know how" or procedural knowledge)		**Affective (Attitude)** **Affective Domain** (feeling and emotion) ("know who" knowledge)
Organization of fire department		Hose evolutions		Attitude
Scope of fire department operation		Ladder evolutions		Interest
Standard operating procedures		Breathing apparatus use		Appreciation
Fire department rules and regulations		Forcible entry		Teamwork
Safety policies		Ventilation operations		Hardworking
Fire behavior – chemistry of fire, types of fire, etc.		Hydrant operation and connection		Trustworthy
Basic physiology of body systems		Salvage operations		Brave
Fire streams and use of nozzles and couplings		Rope use		Risk-taking
Use and types of equipment, such as breathing apparatus		Basic apparatus maintenance operations		Honest
Life-threatening injuries		Cleaning, maintaining, and inspecting equipment, such as breathing apparatus, ropes, salvage equipment, and ladders		Determined
Ventilation methods		Care of hoses and nozzles		Serving others
Salvage process		EMT skills		
Inspection procedures and standards		Recognizing, identifying, and working with hazardous materials		
Reporting		Use of chemical protective equipment		
Safety				
Basic chemistry				
Hazardous materials				

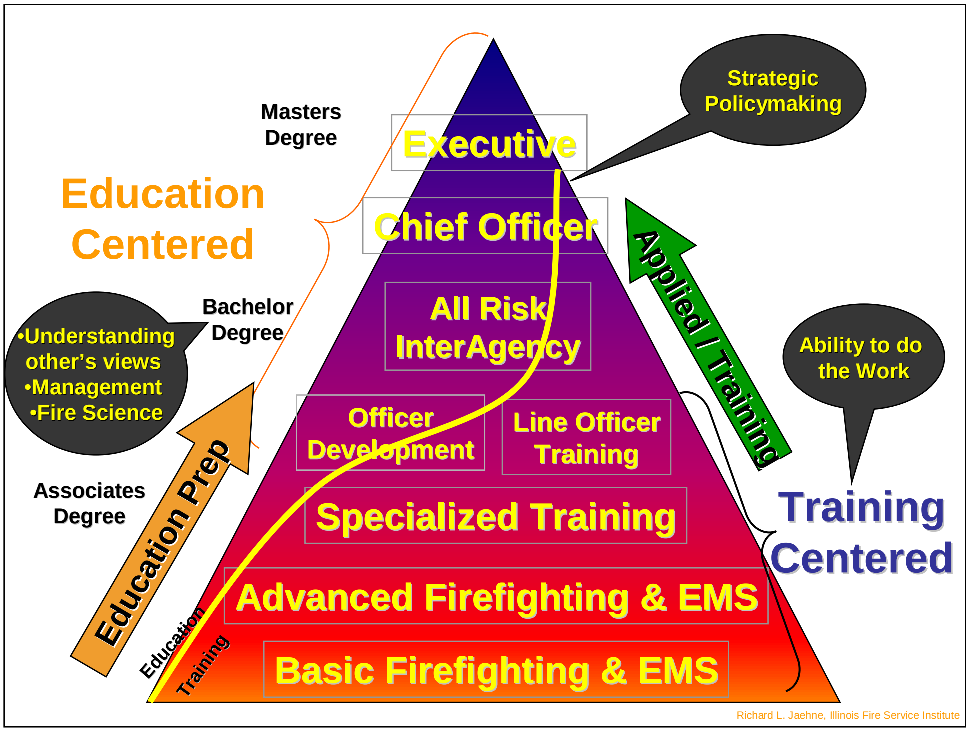
Similarly, Lloyd (2007) created three modalities to describe the knowledge domain of Australian firefighters, including the textual site of codified knowledge (like the cognitive domain), corporeal site of situated embodied knowledge (psychomotor domain) and social site of the community of practice (affective domain), as summarized in Table 2 and discussed in terms of information sources in later chapters.

Table 2. Lloyd's Modalities for Knowledge Domain of Australian Firefighters (Source: Lloyd, 2007)

Textual Site	**Corporeal Site**	**Social Site**
. Codified knowledge	. Situated embodied knowledge	. Social information . Community of practice
. Learning "know why" of knowledge (Billett, 2001, p.xiv) . Knowing about practice	. Tacit knowledge . Observation of the body in actual practice . Acquiring "know how," or procedural knowledge (Ryle, 1949; Billett, 2001)	. Validate actions, values, beliefs, and emotions of the community
. In lectures (novice and probation)	. In training (novice and probation)	. In platoon, the real world (i.e., fire station)
. Learning to "act as a firefighter" . A legitimate member of the workplace community	. Transforming to become a firefighter . A legitimate member of the workplace community	. Intersubjectively embodied member of the community . A member of wider profession and the community of practice . Being a professional firefighter

In order to acquire "know how," or procedural knowledge, experience has played an important role in fire training and emergency response, especially psychomotor domain learning and skills training in KSA, Lloyd's corporeal site of situated embedded knowledge, and the RPD model. The national fire service leaders at the 2002 FESHE (the Fire and Emergency Services Higher Education effort, http://www.usfa.dhs.gov/nfa/higher_ed/index.shtm) IV Conference developed the Fire and Emergency Services Professional Development model as shown in Figure 3. As an experience-based model, it suggested a professional development path for firefighters with training, higher education and certification. For skills- or competency-based training (in the psychomotor domain), it emphasizes that the learning outcomes should provide students with practical applications that give them the "ability to do the work" (Onieal, 2003c). A well-trained firefighter should have good knowledge of all aspects of fireground operations, including each specific type of unit – engine, ladder and rescue (Norman, 1994). Firefighters must continually hone their skills and improve their knowledge of various hazards through training.

Figure 3. National Fire and Emergency Services Professional Development Model



Fire service learning must also concentrate on team members' knowledge (cognitive), skills (psychomotor) and affective (attitude), since in the fire service an individual firefighter's abilities, skills, and physical safety are so closely tied to the actions of other firefighters in the team. Joint team practice helps crew members gradually develop and maintain the necessary coordination (Carter & Rausch, 1999). The performance of every firefighter is closely associated with every other member of the organization (Ertel & Berk, 1998). Team instructional activities of instructors are often reflected in "gang" teaching, training and curriculum development.

The majority of the 50 states in the United States have their own formal fire training academies, such as the Fire Academy, for professional education with physical facilities

(Forsman, 2003; Monigold, 1993). State training programs are managed differently in terms of organization (International Association of Fire Chiefs & National Fire Protection Association, 2006), size and capacity (Onieal, 2003a, 2003b, 2003c, 2003d). In general, the state programs offer training that is not available at local fire departments, including basic recruit training, chief fire officers preparation, hazardous materials awareness, firefighting strategies, farm rescue, and wildland firefighting (Forsman, 2003). A critical ingredient of any successful state training program is its instructors (International Fire Service Training Association, 1990), which holds true for field staff instructors at the Fire Academy, who are the target population of this study.

2.3 THE FIRE ACADEMY AND FIELD STAFF INSTRUCTORS

The site of this study is especially well suited to the project because the Fire Academy is one of the best hands-on training academies in the nation. To fully understand the process of field staff instructors' work practices and information behaviors, I considered the organizational structure and work conditions that influence how they seek and share information and create the instructional climate that affects what problems are addressed, how individual instructors and groups approach these problems, and how and what information is sought and used to support the instructional work. In this section, I explored the structural factors that surround and influence field staff instructors' work practices. The approach presented above was adopted from Palmer's study (1996) that examined interdisciplinary scientists' practices and conditions of boundary crossing research work at an interdisciplinary institute.

As the statutory State Fire Academy designated in 1980, its central objective is to prepare and help firefighters and other emergency responders develop the core skills required to effectively meet the fire emergency service needs of their communities. Under the new Vision 2010 for the Future, the Fire Academy's goal is to find the best way to reach every firefighter in the state with the training, education and *information* he/she requires each year. The Fire Academy applies the Fire and Emergency Services Professional Development model, RPD model, and KSA in its training programs, and emphasizes that training must provide firefighters with the information they need for actual practice, combining conceptual book knowledge with experience-based knowledge. There are 6,000 to 8,000 entry-level firefighters that enter the fire service profession each year who need to be trained. The Fire Academy has established five regional training centers (RTC) operated by field staff instructors at local cities and has developed partnerships for regional training with over 25 fire departments throughout the state. Individual firefighters are now able to attend training classes at these regional training centers and regional partnership sites.

The Fire Academy's major fire training programs (in chronological order) are Fire Officer (1955-), Firefighting (1957-), Fire Prevention (1958-), Industrial Fire (1959-), Rescue (1961-), Fire/Arson Investigation (1962-), Hazardous Materials (HazMat) (1971-), Emergency Medical Services (EMS) (1972-), Cornerstone (1998-), E-learning (2000), Homeland Security (2002) and Agricultural Training (2005-). During the 1980s, according to the Fire Academy's archivist, the Fire Academy shifted its training programs more exclusively to hands-on training. The best hands-on courses are: Saving Our Own, Smoke Divers, Officers Fireground School (which later evolved into 1st-In Officer, Fire Company Officer & Command Officer), RIT (Rapid Intervention Team) Under Fire, FAST (Fire Attack & Suppression Techniques), Truck Company Officer, Tactics & Strategy I & II, Statewide WMD (Weapons of Mass Destruction) Response: Structural Collapse Rescue Operations, and Statewide WMD Response: Structural Collapse Rescue Technician. Following the 9/11 terrorist attacks in 2001, the Fire Academy offered new training dealing with homeland security issues (The Fire Academy Archivist, personal communication, June 20, 2008; The Fire Academy Deputy Director, July 15, 2008).

The Fire Academy constructed a state-of-the-art fire training facility and continues to enhance it. Besides the classroom, the training facility includes the fire station, two structural burn buildings, arson burn buildings, a four-story vertical rescue, confined space and trench rescue training prop, a structural collapse “rescue city,” a liquefied petroleum burn area, agricultural rescue and automobile extrication training areas (The Fire Academy Director, personal communication, August 25, 2010; The Fire Academy Archivist, personal communication, August 27, 2010).

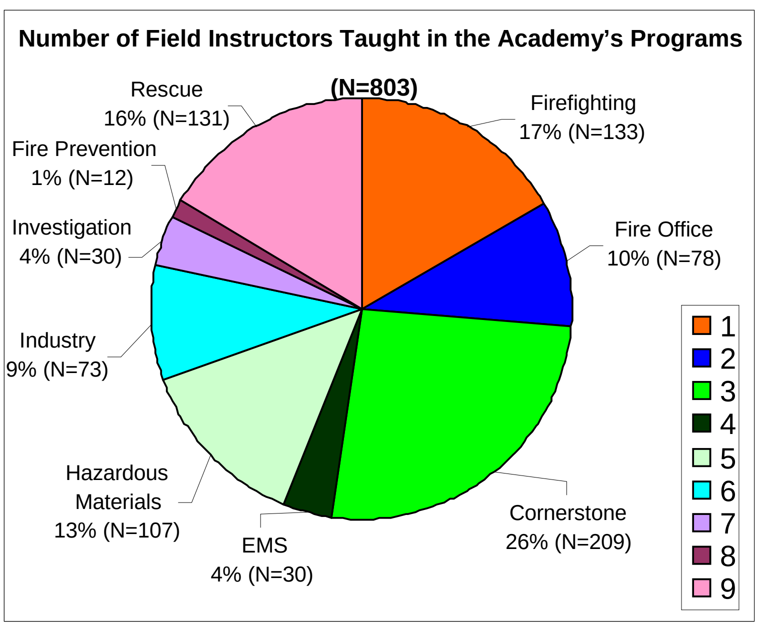
With 85 years of rich history in training, the Fire Academy has designed an effective core curriculum, established the highest level of instructional expertise, and developed a statewide network of hundreds of field staff instructors. Like other state fire academies (Kramer, 1995; United States, National Fire Prevention and Control Administration, 1975), the Fire Academy employs part-time field staff instructors to supplement full-time faculty, and most full-time faculty used to be field staff instructors. The part-time field staff instructors are primarily employed by local fire departments. They are affiliated with both the Fire Academy and local fire departments, which strengthen instructors’ presence in the local community.

At the Fire Academy, field staff instructors work with the Deputy Director, Program Directors in relevant subject areas and the Curriculum Support Specialist in charge of curriculum development, who direct class support and field staff instructors’ professional development. Field staff instructors need to consider which of Bloom’s three domains their objectives are drawn from while writing objectives for training and teaching. They use Simpson’s *Classification of Educational Objectives, Psychomotor Domain* to set teaching and training guidelines (Simpson, 1966). Field staff instructors also assist in the academy's consultation, evaluation, and research activities. Field staff instructors are professional personnel with knowledge, skills, and attitudes extracted from years of experience, training, and education (Guzzi, 2007). They all contribute to the Fire Academy teaching, training, and curriculum development in their own particular ways.

Field staff instructors conduct instructional work based on street experience and apply it to theory as needed. Among the respondents to my 2007 survey, entitled *Information Needs and Uses of Field Staff Instructors*, 33% had more than 25 years of experience as a firefighter; 18%, 21-25 years; 17%, 16-20 years (Q6). A great deal of the fire service's past is still held in the inventory of tools, equipment, and methods (Coleman, 2004; Guzzi, 2007; Linstrom, 2006). Traditionally, older, more experienced members passed along firefighting skills and knowledge to the next generation of firefighters who were just beginning their careers (Fritz, 1997). Fire service instructors share their experiences and advice with each other and with students. They teach and demonstrate skills they learned and manipulated at emergency scenes because they have performed these skills hundreds of times. The instructor's experience is directly passed on to the student, thus creating little need for the student to test and trial these lessons. Students are able to solve new problems, depending on previous experience, since experience points the right way to carry out the new job (International Fire Service Training Association, 1990). In a short time frame, students receive immediate and frequent feedback from field staff instructors to strengthen progress, and instructors provide students instant coaching, guidance, and recognition (Baker, 2006; Holiday, 2006).

The Fire Academy's field staff instructors are comprised of experts from a variety of fire service subject domains. The results of my 2007 survey indicate, among 118 respondents who answered the question about their areas of specialty, 108 answered firefighting; 64, rescue; 57, hazardous materials; 54, auto extrication; 44, emergency medical services; 28, homeland security; 23, fire investigation; and 22, other areas (Q16). Among 110 respondents, 55% (n=61) taught for the Fire Academy for one to five years; 30% (n=33) for six-ten years; 12% (n=13) for 11-15 years; 2% (n=2) for 16-20 years; and 1% (n=1) for 21-25 years (Q36b). Figure 4 below shows that 803 field staff instructors taught the Fire Academy's training programs from 1970 to 2008 and some taught more than one course, according to the Fire Academy's Staff Resource Database. The Cornerstone Program (basic skills of firefighting) has the most instructors, 26%; the Fire Prevention Program has the fewest instructors, 1%. Field staff instructors coordinate and teach several types of specialized courses offered mainly off-campus at RTC or local fire departments.

Figure 4. Number of Field Instructors Taught in the Fire Academy's Programs

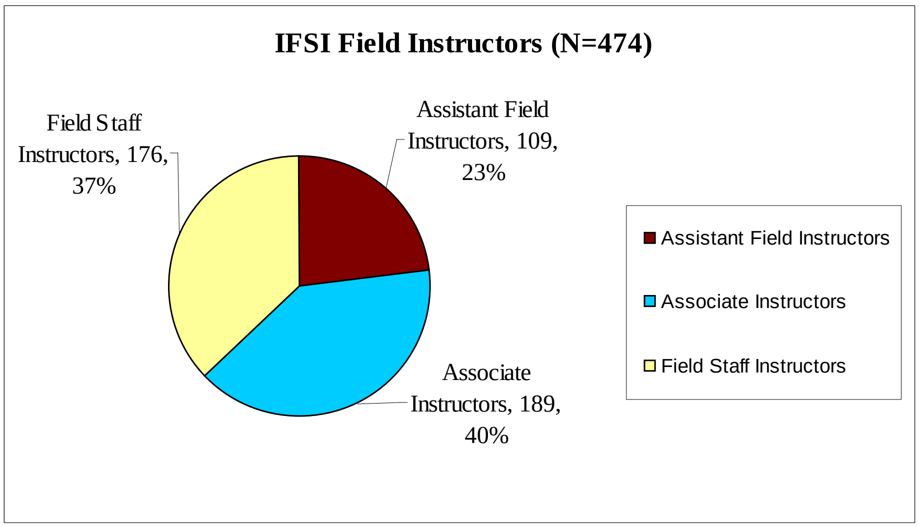


The field staff instructors are the creators of new curricula as the key instruments to support the Fire Academy's ongoing curriculum development process. They explore and integrate their specialized knowledge to create training curricula that help train firefighters. The Fire Academy's field staff instructors operate differently from most other fire service instructors because "they are driven by practicality and real world experience, which is the heart of the Fire Academy's curricula development" (The Fire Academy Deputy Director, personal communication, July 15, 2008). The courses in the Firefighting Program, which have evolved during the 85-year history of the Fire Academy, demonstrate how field staff instructors have been heavily involved with the Fire Academy curriculum development, as shown in Appendix D (also see detailed course descriptions in Appendix E). The curriculum development team for a given course has members ranging from two to ten, and it may obtain feedback from another larger group of 12 to 15 instructors. The Fire Academy's Curriculum Support Specialist provides direct support and guidance to field staff instructors for their curriculum development on individual courses. The Deputy Director grants final approvals of the courses. Field staff instructors demonstrate substantial decision-making responsibilities during the curriculum development. The Fire Academy and fire service profession in the state have a need and desire to get the curriculum standardized for professional training, certification and accreditation by following the same format of course outline, by adopting required standards both from the National Fire Protection Association (NFPA, http://www.nfpa.org) and the Office of the State Fire Marshal, and by citing appropriate reference materials.

Field staff instructors are the Fire Academy's and state fire service's key training force, and many of them are active library users. See the sample Fire Academy training calendar in Appendix C to learn about their academy training activities. A field staff instructor serves as a fire emergency service resource and acts as a role model. Field staff instructors are expected to actively participate in the Fire Academy's programs on a regular basis. Though they have traditionally been expert firefighters in the state, field staff instructors have come to include firefighters from around the United States beginning in the 1980s.

The three ranks for field staff are assistant field staff instructor, associate field staff instructor, and field staff instructor. According to the Fire Academy's Staff Resource Database, among 474 field staff instructors, 40% are associate field staff instructors, 23% are assistant field staff instructors and 37% are field staff instructors, as shown in Figure 5.

Figure 5. Ranking of the Fire Academy's Field Staff Instructors



As the oldest continuous state fire academy in the United States, which began in 1925, the Fire Academy has established a well-thought out system to attract, recruit, and promote field staff instructors to maintain its historically top-ranked hands-on training programs. The Fire Academy selects field staff instructors from the top fire service instructors in the state and from recognized specialists in related fields. The table listed below summarizes the Fire Academy's field instructor hiring criteria (see more in Appendix F).

Table 3. Summary of Selection Criteria for the Fire Academy's Field Staff Instructors

Criteria	**Assistant Field Instructors**	**Associate Field Staff Instructors**	**Field Staff Instructors**
Teaching Experience	X (in own department)	X (teaching supervision & evaluation) (min. 60 hours teaching)	X
Operational Experience	X (3+ yrs)	X (5+yrs)	X
Acknowledged Professional Reputation	X	X	X
Approval by Chief	X		
Recommendation Letters	X		
Membership in Fire Service		X	X
Leadership		X	X
Curriculum Development	X	X	X
Continuing Education		X	X
Pursuit of Higher Education Degree		X	X
Research Publications		X	X
Regular Involvement with the Fire Academy			X
Notable Contributions to Fire Service			X

Recruiting, developing and maintaining high quality field staff instructors are one of the primary functions of the Fire Academy. The hiring criteria emphasize experience in teaching, training, operations, and involvement in curriculum development. Continuing education and research requirements reflect a strong fire service training culture, which emphasizes personal experience, expert reputation, lifelong learning, and the ability to do research. Both associate field staff instructors and field staff instructors are required to have standard-setting committee experiences, to be involved with curriculum development and to serve as a "point of local contact." Cognitive authority, that knowledge construct from first-hand experience (Wilson, 1983), is required for all levels of field staff instructors. Clearly, teaching, training, and curriculum development activities are deeply interlaced. Throughout these activities, field staff instructors communicate and exchange information, develop a shared understanding of fire service practices and work in a coordinated team fashion to achieve the mission. The Fire Academy is sustained by the field staff instructors' successful efforts in instructional work.

Serving as the central location of the state training programs, the Fire Academy brings field staff instructors from different locations and specialization areas together. Its structure has been intentionally designed to facilitate individual-, group-, and experience-based instructional activities. It cultivates closely knit social network activities of field staff instructors and helps them exchange and share information through regular regional meetings, state and national conferences, newsletters and by bringing in instructors and experts from other states, industry and government agencies. It also provides a thoughtful online resource center, sophisticated IT systems to connect field staff instructors 24/7, and a quality training facility. The office hubs inside the current Academy building are deliberately arranged to promote professional and social interactions among field staff instructors. The field staff instructors in the same subject area are often clustered together in one small office area, desks next to each other, elbow to elbow. The library has a meeting table that is frequently occupied by the field staff instructors when they visit the Fire Academy. A new building for the Fire Academy, expected to be completed by fall 2010, will have designated spaces with state-of-the-art technology facilities for promoting field staff instructors' social networking and professional interactions.

The instructor participants in this study explicitly acknowledged their privileged position at the Fire Academy, naming it a "family" where people sincerely care about each other, and a "place" where they accelerated career development and thrived professionally. Their close organizational ties with the Fire Academy are very much a part of how they practice teaching, training and curriculum development. This interdependence between the Fire Academy and field staff instructors makes it absolutely necessary in this study for me to recognize the situated nature of field staff instructors’ work practices and to consider it in the analysis of their information-seeking and sharing behaviors in later chapters.

CHAPTER 3

LITERATURE REVIEW

The goal of this chapter is to synthesize and interpret the findings from a wide variety of representative scholarship that informs this study. The review consists of three areas: user studies of professional groups, group interdependence, and collaborative information-seeking and sharing. The user studies of professional groups section discusses research concerning the information-seeking behavior of divergent types of professions but focuses primarily on that of engineers, since engineers were found to be the most similar to the fire service field staff instructors. The communication literature on group interdependence turned out to be the most insightful and helpful for my study. The review discussion on collaborative information-seeking and sharing emphasizes the studies of engineer teams and introduces the transactive memory system (TMS). The topics included bring together three areas of study that have not previously been discussed at one place. The findings provide stimulating insights to this study's research questions, interview guide, data collection and data analysis. They are germane to the study findings I will be presenting in the later chapters.

My review is drawn from many Library and Information Science (LIS) sources, including the *Annual Review of Information Science and Technology (ARIST), Wilson's Library Literature and Information Science*, print and electronic journals on the topic and a sampling of general publications. Besides LIS literature, I reviewed pertinent literature from the fields of communication, education, and knowledge management. A number of bibliographic databases germane to fire and engineering domains were searched, including *Engineering Index*, *INSPEC, PubMed, Firedoc* and *USFA/FEMA Online Catalog* for print and electronic resources. In addition, information was reviewed from other federal agencies, such as the Federal Emergency

Management Agency (FEMA), and from private industry sources, such as the National Fire Protection Association (NFPA). I also consulted directors, program directors and the archivist at the Fire Academy. Most of the reviewed studies concentrate on North American approaches, and all the cited sources are in English, although the research community is increasingly international (Case, 2007). Disappointingly, no studies on fire service instructors' information behaviors were found.

Due to the broad, fragmented, and mixed nature of the literature, the scope of this review is limited and highly synoptic. The intent is to be representative rather than exhaustive, drawing conclusions from an analysis and synthesis of main themes and specific findings that are illuminative and applicable to the study.

3.1 USER STUDIES OF PROFESSIONAL GROUPS

As Pierce (1987) said, "to call an occupation a 'profession' normally means that its practice involves the application of a body of knowledge in the service of others" (p. 143). Winter (1988) concurred that "profession" means those service-oriented occupations having a theoretical knowledge base, requiring a broad, formal postsecondary education, having a self-governing association and complying with internally created codes of ethics or other principles. Abbott (1988) argued that the starting point to understand professions must be professional work, which advised me where I should start with my study participants. Professionals primarily generate services. In any given day, they perform tasks with multiple roles, including roles related to the provision of specific expertise and knowledge, and managing, counseling, supervising, planning and research (Abbott, 1988). I will identify and summarize the field staff instructors' roles and tasks in Chapter 5. Groups displaying some or all of these criteria include doctors, lawyers, teachers, clergy, nurses, physiotherapists, librarians, accountants and engineers

(Leckie, Pettigrew, & Sylvain, 1996, p. 162). One profession that fits the criteria is the fire service, which includes fire service instructors, such as the Fire Academy's field staff instructors, among its personnel.

Leckie (2005) suggested that there has been a strong interest in the literature of LIS in examining the information-seeking practices of practitioners within various fields of professional work. Studies have examined the information-seeking behaviors and information uses of different professional groups to determine what information practices are embedded within professional work, how those information-related practices function to contribute to the work, and whether or not those practices can be improved or changed for the better (Leckie, 2005, p. 159). Yet Case (2007) observed that only a few empirical studies focused on information-seeking behaviors of specific professional groups. It is generally accepted that we still know far too little about users in different professional groups. I discovered user studies for specific professional groups in the past decade as shown in Table 4. Groups studied have included engineers, law enforcement personnel, teachers, managers, lawyers, and physicians. For example, Wilson and Streatfield (1977) studied the information-related practices of social workers in a government agency and opened the door for studies of other, nonacademic professionals (Leckie, 2005). Tushman (1978) examined the differences and similarities of information-seeking behavior among types of professionals. Pinelli (1991) suggested that five institutional variables may offer answers to differences between individuals in their use of scientific and technical information: type of researcher (engineer or scientist), nature of discipline (basic or applied), state of project task or problem completeness, type of organization (academia, government or industry) and years of professional experience. Other researchers also considered factors such as age, career stage and area of specialization (Govindarej, Pejtersen, & Carstensen, 1997; Guinan, Cooprider, & Faraj, 1998; Leckie, Pettigrew, & Sylvain, 1996; Sonnenwald & Lievrouw, 1997; Vickery & Vickery, 1989).

Table 4. User Study Research for Specific Professional Groups

Professional Group	Sample Works
Workers in public administration	Byström & Järvelin, 1995; Malek-Mohammadi, 2000; Mohammadi, 2002; O'Reilly, 1982; Tiamiyu, 1992
Engineers	Allard et al., 2008; Allen, 1969, 1977; Anderson et al., 2001; Brown & Utterback, 1985; Bruce et al., 2003; Court et al., 1998; Ellis & Haugan, 1997; Fidel & Green, 2004; Freund et al., 2005; Gerstberger & Allen, 1968; Gerstenfeld & Berger, 1980; Gralewska-Vickery, 1976; Hertzum, 2000, 2002; Holland & Powell, 1995; Kerins et al., 2004; King et al., 1994; Kremer, 1980; Kwasitsu, 2003; Leckie et al., 1996; Pinelli, 1991; Shuchman, 1981; Tackie & Adams, 2007; Tenopir & King, 2004; Tushman, 1978; Ward, 2001; Yitzhaki & Hammershlag, 2004
Law Enforcement Personnel	Baker, 2004
Lawyers	Banks, 1994; Bresnick, 1988; Cohen, 1969; Cohen et al., 1989; Haruna & Mabawonku, 2001; Kerins et al., 2004; Kuhlthau & Tama, 2001; Leckie et al., 1996; Mayer, 1966; Otike, 1999; Rogers & Cooper, 1979; Sutton, 1994; Vale, 1988; Walsh, 1994; Wilkinson, 2001
Managers	Alwis et al., 2006; Auster & Choo, 1993; Baldwin & Rice, 1997; Choo, 1994, 2001a, 2001b; Correia & Wilson, 2001; Culnan, 1983; Daft & Lengel, 1986, Daft et al., 1988; Farhoomand & Drury, 2002; Hirsh & Dinkelacker, 2004; Huotari & Chatman, 2001; Katzer & Fletcher, 1992; Mackenzie, 2002, 2003a, 2003b, 2004, 2005; McGee & Sawyer, 2003; Niedzwiedzka 2003; Pezeshki-Rad & Zamani, 2005; Widen-wulff, 2003; Zeffane & Gul, 1993
Physicians	Covell et al., 1985; Donat & Pettigrew, 2002; Ely et al., 1992; Gorman, 1995, Gorman & Helfand, 1995; Gruppen, 1990; Haug, 1997; Ocheibi & Buba, 2003; Osheroff et al., 1991; Timpka & Arborelius, 1990; Urquhart, 1998, 1999
Teachers	Savolainen, 1995; Stefl-Mabry, 2005

To study information-seeking and sharing of professionals, it is important to understand professional knowledge structures in general and in the particular domain. Pierce (1987) argued that no literature deals effectively with the question of what professional knowledge is like and how it differs from other knowledge. She suggested that the bodies of knowledge in both “professional” and “scientific” fields are structured in patterns influenced by the institutional organization of fields and by the content of their research training programs and their literatures. Thus, the structure of knowledge in the professions is different from knowledge structures in the sciences. The nature of scientific knowledge is “pure science” and that of professional knowledge is “technical application.” In the fire service domain, technical application is demonstrated through psychomotor domain learning and skills training, as discussed in Chapter 2 and shown in Table 1.

Findings on the nature and development of professional knowledge in recent studies were relevant to my research when I examined the fire service knowledge structures of KSA and explored the role the KSA structures played in the instructor participants’ information-seeking. Researchers argued that professional knowledge can be so deeply embedded in people’s work routines and practices (Cranefield &Yoong, 2009; Davidson & Voss, 2002), and the actual tasks of practice are complicated and changing (Leinhardt, Young, & Merriman, 1995), similar to my findings described in Chapter 5, 7 and 9. Some researchers suggested professional knowledge is gained in practice as procedural, specific, and pragmatic (Leinhardt, Young, & Merriman, 1995). Compared to codified knowledge provided by professional associations, researchers indicated that professional knowledge at the individual level appears strongly activity-oriented, highly context-specific, and personalized (Borko & Putnam, 1996; Bromme & Tillema, 1995; Connelly & Clandinin, 1985; Elbaz, 1983; Tillema, 1995). The more work experience increases, the more it becomes personalized (Tillema, 1995). These findings match what I found about the instructor participants’ street expertise and street experience in Chapter 7. Professional knowledge can become “sticky” or “tacit” because it is difficult to obtain, organize, convey to other people, and convert into other formats (Argote & Ingram, 2000; Badaracco, 1991; Jensen & Szulanski, 2004;

Szulanski, 2000). I will report how the instructor participants find ways to pass on their personalized professional knowledge to other instructors and students, and I will suggest applying knowledge management methods to collect, organize, and make that knowledge accessible in Chapter 10. Cranefield & Yoong (2009) proposed that professional knowledge underpins and governs individuals' performances in a profession, such as engineering, project management or teaching, and individuals use it to interpret and understand their work (p. 258). In later chapters, my findings uphold their claim and indicate that fire service knowledge structures of KSA -- (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) -- influence the changing needs of instructor participants, define the boundaries of information sources in three domain areas that firefighters are required to learn, and dictate multiple types of information sources used by the instructor participants.

Following an early series of studies by Allen (1977), studies of engineers have identified some well-defined patterns of information practices and information-seeking behaviors, and I summarize them in the following sections.

3.1.1 Characteristics of Engineers

This section compares engineers to fire service field staff instructors, in spite of different work settings. It offers the logical reasons that I focused the literature review on information-seeking behavior of engineers and how the study findings of engineers' information-seeking provided important insights related to that of the instructor participants.

Leckie, Pettigrew, and Sylvain (1996) described engineering as a highly specialized profession (mechanical, chemical, electrical, etc.), working in a wide range of environments. Fire service field staff instructors are highly specialized as well, working in a broad range of environments. Most engineers can be distinguished as subject specialists who undertake rather complex tasks (Hertzum & Pejtersen, 2000), as do the field staff instructors described in Chapter 5. Engineers' visual representations, such as sketches and drawings, are central (Henderson, 1999) to them. The fire service's material representations, such as tools like self-contained breathing apparatus, are central to the work of firefighters and field staff instructors. Generally working in small teams, engineers carry out several tasks associated with each role or function, such as research, government, management, consulting, sales, design, development, testing and manufacturing of items (Kemper, 1990; Sonnenwald, 1995). Field staff instructors often work in small groups, performing multiple roles as I will demonstrate in Chapters 5 and 8. Engineers seek workable and reliable solutions to specific problems and always make decisions within time constraints. The engineer's main goal is to produce or design a product, process, or system; and to transfer scientific and empirical knowledge to practical use and develop useful products, processes, and services. It is not a priority to publish and make original contributions to the scholarly literature (Anthony, East & Slater, 1969; Blade, 1963; Cairns & Compton, 1970; Hertzum & Pejtersen, 2000; Joenk, 1985; Kemper, 1982; Kennedy et al., 1997; Landau & Rosenberg, 1986; Leckie, Pettigrew & Sylvain, 1996; Marquis & Allen, 1966; National Academy of Sciences, 1985; Pinelli, 1991; Price, 1965; Simon, 1992; Taylor, 1986; Vincenti, 1990; Young & Harriott, 1979). Field staff instructors also train firefighters to look at applicable solutions and make decisions at emergency response scenes under time and life-threatening constraints.

Engineers are known to be highly driven and heavy users of information (Freund, Toms & Waterhouse, 2005; Shuchman, 1981). So are the instructor participants, as demonstrated in later chapters. Engineers demand more information than they generate. So do field staff instructors. Engineers spend 20% to 80% of their work time looking for and using information

(King, Casto, & Jones, 1994; King & Griffiths, 1991). Often constrained by time and budget considerations (Fidel & Green, 2004), engineers typically seek a small amount of "good enough" information (Orr, 1970). But the instructor participants never stop finding something new, as I will discuss in Chapter 9. Anthony (1986) revealed that engineers write for publications less, tend to look only for readily accessible sources, and are more quickly discouraged by their lack of success in finding relevant information. As task complexity soars, so does the complexity of the information needs of the engineers, while the number of useful information sources decreases (Byström & Järvelin, 1995). Kwasitsu (2003) investigated information-seeking behavior of the design, process, and manufacturing engineers in an international microchip manufacturing company, and one of his findings suggested significant differences in information-seeking behaviors among these engineers. But Pinelli and associates (1993) argued that, despite the extraordinary diversity in practice, engineers use information in essentially the same ways. In later chapters, I will discuss more uniform information-seeking and sharing behaviors among the instructor participants.

In the engineering design domain, Ullman (1992) suggested three types of knowledge that engineering designers use and access during their work: 1) General knowledge acquired through daily experiences and general education; 2) Domain-specific knowledge acquired through study and experience within the specific domain that the designer works in; and 3) Procedural knowledge acquired from the experience of how to undertake one's tasks within the enterprise concerned. I see cognitive knowledge obtained in the fire service training as equal to domain-specific knowledge and procedural knowledge gained through skills training. Ferguson (1992) emphasized that the formal knowledge engineering designers use includes knowledge based on experimental evidence and on empirical observations of materials and systems. He argued engineering designers acquired knowledge only by having a good appreciation of the area and the domain in which they work. Considering historical traditions to examine technical communication among earth science engineers in her study, Gralewska-Vickery (1976) reported that earth science engineers developed knowledge from craft traditions and mastered the profession based on word-of-mouth transfer of information similar to how field staff instructors train firefighters through hands-on practices discussed in Chapter 7.

3.1.2 Information-Seeking Behavior of Engineers

Engineers were among the first to be studied as users of information in the past 30 years (Fidel & Green, 2004). There has been a large body of empirical studies in general, with a number in Research and Development (R&D) in particular. This literature was extensively reviewed by King, Casto, and Jones in 1994 (see more studies on information-seeking of engineering in Appendix G). Although many studies have been conducted to investigate the information-seeking behavior of engineers, Pinelli and associates (1993) argued that the literature is scattered and unreflecting. The results have not aggregated to develop a significant body of knowledge, and certain areas have not been fully studied. For example, some past studies have treated engineers with scientists as one broad and loose category of user group (e.g., Bates, 1994, 1996; Case, 2007; Crawford, 1971; King, Casto, & Jones, 1994; Nelson & Pollock, 1970; Pinelli et al., 1993; Price, 1963). Few studies have focused on professional engineers in R&D industries (King & Griffiths, 1991). Freund, Toms, and Waterhouse (2005) noted that little research identifies a causal relationship between the factors and the behaviors. Few studies have examined the use of databases by engineers (Case & Borgman, 1986). Based on case studies in two product-development organizations, Hertzum and Pejtersen (2000) concluded that engineers look for documents to locate people, look for people to obtain documents, and interact socially to acquire information without launching clear searches. They observed that information-seeking is a well-developed research field for written information, but research on the retrieval of oral information, i.e. searches for informed people, has been ignored despite its extreme importance in engineering work. Hertzum and Pejtersen's (2000) study findings prompted me to turn closer attention to people as sources of information in my study.

While various theories and frameworks have been developed for the study of human information behavior (e.g., Pettigrew, Fidel, & Bruce, 2001), the study of engineers' information-seeking behavior began without any theoretical or conceptual framework (Fidel & Green, 2004). Various attempts to model engineers' information-seeking were summarized by Leckie, Pettigrew, & Sylvain (1996), including Orr's time-allocation model of communication behavior, Paisley's (1968) model using a systems approach, Vickery and Vickery's (1989) several models of the different aspects of information retrieval and use by engineers, and Pinelli's (1991) comprehensive model of information-seeking of the engineer-scientist. Compared to these models, Leckie's model of the information-seeking of professionals is more applicable for my study because it is a general model associated with professional groups.

Researchers have utilized various methods to investigate engineers' information needs and use (Kwasitsu, 2003). For data collection, the common research methods are questionnaires or structured interviews (Fidel & Green, 2004; Pinelli et al., 1993). Surveys dominated in the studies of the previous three decades (e.g., Anderson et al., 2001; Jones, LeBold, & Pernicka, 1986; Kaufman, 1983; King, Casto, & Jones, 1994; Kremer, 1980; Raitt, 1988; Tushman, 1978; Tushman & Scanlan, 1981a, 1981b). The interview method has been applied in recent studies of engineers' information-seeking, and its use has demonstrated more depth in the questions asked (Case, 2007; Kerins, Madden, & Fulton, 2004). For example, Fidel and Green (2004) conducted detailed interviews with 32 engineers from a variety of fields. The engineer participants delineated incidents of personal information-seeking in depth and disclosed their perceptions of the accessibility of information sources. The concept of accessibility was found to be multi-dimensional, and the authors found that engineers depend on a series of associated factors in choosing information, such as familiarity with source, efficiency of use, physical proximity, format, and level of detail (Fidel & Green, 2004). I will discuss how I selected the interview method for my study in the next chapter.

Other approaches were found in the literature. Allen and Cohen (1969) applied the sociometric study and discovered that engineers' social and work reasons for communicating with colleagues overlapped. Their closer investigation of "sociometric stars" in laboratories became a classic example of the role of gatekeepers in organizations (Metoyer-Duran, 1993). Using case studies in two product-development organizations, Hertzum and Pejtersen (2000) concluded that engineers interacted socially to get information. Hertzum's (2002) study was based on the observation and analysis of 16 fortnightly project meetings to investigate the importance of trust in software engineers' assessment and choice of information sources. Bruce and associates (2003) used a combined approach of interviews, think-aloud protocols from observations and meetings, and email threads to collect data from two design teams at the beginning stage of a software-engineering project and an aviation-engineering project. They found that collaborative information-seeking happens when the engineers discuss the information problems and develop information-seeking strategies. Combining observations with interviews, Fidel and Green (2004) used the "Cognitive Work Analysis" framework to guide their field study of one event of collaborative information retrieval (CIR) carried out by design engineers at Microsoft. Fidel and associates (2004) employed a variety of measures and methods to examine collaborative information gathering and sharing among members of design teams at Microsoft and Boeing. They illustrated the use of "Cognitive Work Analysis" to explore various dimensions of the tasks they studied, such as the cognitive dimension, task situation, the nature of the information sources, the nature of the information needed, the organization of the team's work, and the organizational culture. The study provided a detailed and in-depth understanding of the interaction dynamics of collaborative information behaviors during problem-solving and decision-making. Fidel and Green found that a CIR event could become a forum for eliciting information from participants, acquiring information is an integral part of design work and CIR could serve social and organizational purposes.

3.1.3 Reliance on Informal Sources of Information

Sources or channels of information employed by professionals can be categorized as formal or informal. Garvey and Griffith (1968) defined formal channels as those bearing information that was public, impersonal and kept in permanent storage (Russell, 2001). Informal channels bearing information are relatively temporary, held by either one-to-one communication channels or one-to-many channels for controlled audiences (Garvey, 1979).

Engineers do use printed sources, such as reports, catalogs, handbooks and trade journals more than research publications, but researchers of engineers' information-seeking consistently and repeatedly have observed that engineers prefer using internal channels for information, which consist of their personal knowledge, colleagues, personal files, personal experimentation, personal experience (King & Griffiths, 1991) and other sources of information inside their organization rather than technical literature, libraries and sources outside their organization (e.g., Allen, 1969, 1977; Allen & Cohen, 1969; Bichteler & Ward, 1989; Bishop, 1994; Court, 1997; Ellis & Haugan, 1997; Fidel & Green, 2004; Hertzum & Pejtersen, 2000; Jones, LeBold, &

Pernicka, 1986; Kaufman, 1983; King, Casto, & Jones, 1994; Kremer, 1980; Leckie, Pettigrew, & Sylvain, 1996; Nkereuwem, 1984; Pinelli, 1991; Raitt, 1988; Rosenbloom & Wolek, 1967; Shuchman, 1981, 1982; Taylor, 1986; Von Seggern & Jourdain, 1996). I will illustrate the instructor participants' similar preference in Chapter 7.

Studies have revealed that oral communication was predominant among engineers, depending heavily on colleagues' and supervisors' knowledge (Fishenden, 1965; King & Griffiths, 1991). Engineers spent 40% to 60% of their time communicating to get feedback about their work and to produce results from their work (King, Casto, & Jones, 1994). The most accessible and familiar sources are typically perceived as personal contacts with co-workers or suppliers (Allen, 1977; Gerstberger & Allen, 1968; Hertzum & Pejtersen, 2000), and these contacts have a more considerable role in engineers' information transfer than printed sources (Tackie & Adams, 2007). Several studies revealed that engineering design documentation was often not completed; it was tacit (Button & Sharrock, 1996; Hertzum, 1999; Parnas & Clements, 1986). "Technological documentation is often most useful only when the author is directly available to explain and supplement its content" (Allen, 1988, p. 10). In design documentation, engineering designers usually document the technical solutions and the result of the design, but they do not make information about the context of the design process available or easily accessible (Court, 1997; Hertzum & Pejtersen, 2000). Therefore, oral communication with a coworker is preferred as a starting point, since the coworker can explain the work context and the available written sources (Hertzum & Pejtersen, 2000). Similarly, Pinelli (1991) and Anthony (1986) proposed that engineers do not find answers in the literature but have a psychological predisposition to solve problems by themselves, relying heavily on the past experiences of colleagues who are experts in the field (Tackie & Adams, 2007). Interviewing 60 engineers about their information sources at work and the relative importance of the sources, Holland and Powell (1995) examined the importance of interpersonal information-seeking among engineers. They reported that the single highly-rated source is “word of mouth,” compared to engineers’ personal collections and libraries or databases. The most highly-ranked “people” source of information is their own expertise of knowledge and experimentation. The highest ranked interpersonal sources by engineers are people within his own work group, followed by others in and outside the company. Shuchman’s (1981) findings indicate that regardless of discipline, engineers begin with their own store of information, and then talk first with colleagues, then with supervisors. There are many similarities in these research findings to the instructor participants’ informal and personal sources of information as I will report in Chapter 7.

Allen and Cohen (1969) defined technological gatekeepers as individuals who held key positions in the communication network of the domains. Those individuals were most often sought by others in the laboratory for technical advice and consultation since they were the ones who developed more technical contact outside of the laboratory. Most studies on engineers confirmed the existence of the so-called “stars,” “gatekeepers,” or “boundary spanners” who were trustworthy sources of internal and external information in the organization (Aloni, 1985; King, Casto, & Jones, 1994; Kremer, 1980; Shuchman, 1981; Yitzhaki & Hammershlag, 2004). In Chapter 7, I will report that gatekeepers found in the instructor participants were often the lead instructors of the groups.

Consistently, researchers have found that when engineers use written sources, they tend to consult textbooks, technical reports, catalogs, and trade journals, conference papers and other external sources, rather than scholarly publications (Allen, 1977; Shuchman, 1981). I’ll discuss the use of print materials, rather than scholarly publications as well, by the instructor participants in Chapter 6. Studies have shown that the average engineer makes little or no use of the scientific and professional engineering literature (Allen, 1966, 1977; Berul et al., 1965) within the context in which most engineers work, such as in private firms (Case, 2007). If engineers need further information, they use technical reports, look for gatekeepers in the firm, and finally turn to various formal sources. They hardly acquire all the information they need for solving technical problems in one source (Case, 2007). I'll discuss the instructor participants' integration of multiple sources of information in Chapter 9.

Few studies have shown libraries to be the first place engineers look for information (King & Griffiths, 1991; Kremer, 1980; Poland, 1991; Shuchman, 1981). Allen (1977) concluded that librarians might be able to provide better services if they knew the names of the gatekeepers in their organization, so librarians could be more engaged in the informal information communication network of engineers. Studies by Weinschel and Jones (1986), Batson (1987), Mailloux (1989), and Hurd, Weller, and Curtis (1992) indicated that engineers failed to make use of electronic information sources because information systems were challenging to utilize and could not directly satisfy the problem-oriented information needs and complex decision-making processes of engineers. Kwasitsu (2003) investigated engineers working on the design, process and manufacturing of microprocessors and found that the higher the level of education engineers acquired, the less likely they were to depend on their memories, and the more likely they were to rely on libraries. I will discuss the instructor participants' active use of libraries in Chapter 6 and how some of them started research in the Fire Academy's library.

3.1.4 Factors on Choices of Information Sources

Studies have reported that a range of factors, such as technical quality, degree of experience with the source, the cost associated with using the source (i.e., its accessibility and ease of use or time required) (Hertzum, 2002; King, Casto, & Jones, 1994) and time saving (Fidel & Green, 2004), affect engineers' choices of information sources. Pinelli (1991) argued that accessibility was the most decisive factor of selecting information sources for engineers working in industrial R&D, and many researchers had similar findings (e.g., Allen, Gerstenfeld, & Gerstberger, 1968; Chakrabarti, Feineman, & Fuentevilla, 1983, see review articles by Fidel & Green, 2004; Hertzum & Pejtersen, 2000; King, Casto, & Jones, 1994; Leckie, Pettigrew, & Sylvain, 1996; Pinelli et al., 1993; Yitzhaki & Hammershlag, 2004; Young & Harriott, 1979). Researchers have generally used the "principle of least effort" (Zipf, 1949) to explain engineers' preference for nearby, internal information sources because they choose information sources based on ease of access rather than quality of contents (Hertzum, 2002; King, Casto, & Jones, 1994; Pinelli et al., 1993; Yitzhaki & Hammershlag, 2004). Fidel and Green (2004) disclosed some variation among their engineer respondents; for example, saving time was the main criterion for choosing documents, while familiarity was the leading factor in selecting people as sources of information.

However, Anderson and associates (2001) argued that the "principle of least effort" could not adequately explain how engineers selected written information sources. Based on their studies, Hertzum and Pejtersen (2000), Hertzum et al. (2002) and Hertzum (2002) offered an alternative explanation that a preference for people as information sources was due to known or easily determinable trustworthiness. Gralewska-Vickery (1976) suggested that the types of information most needed by engineers and the sources of information they most used varied according to career stage from student and junior engineer to intermediate and senior stages, due to the change of duties, degree of supervision, and role in decision-making and leadership. These findings are informative and germane to my study. I will discuss factors regarding the instructor participants' selection of information sources in Chapter 7.

3.2 GROUP INTERDEPENDENCE

It is important to understand group interdependence and its role in information-seeking and sharing, since fire service field staff instructors often work in teams to undertake instructional work. In this aspect, the communication literature informed this area of my research the most, since members of groups are more effective when they can successfully access, retrieve and translate information among their group members.

Much of the existing information-seeking literature has primarily focused on the individual (Dumais et al., 2000; Hyldegård, 2006; Poltrock et al., 2003a, 2003b; Prekop, 2002; Sonnenwald & Pierce, 2000), such as studies by Belkin, Oddy, & Brooks (1982), Belkin (1984), Borgman (1986, 1989), Dervin (1983a, 1983b), Ingwersen (1984), Koenig & Wilson (1996), Kuhlthau (1990, 1991, 1993b), Nilan, Peek & Snyder (1988), and Wilson (1984, 1994). Implicit in most information-seeking models (e.g., Kuhlthau's [1993a] model of the individual information search process; Wilson's [1999] interdisciplinary general model of human information behavior) is the hypothesis that the information-seeking is performed individually (Reddy & Dourish, 2002), though it is commonly recognized that individuals often collaborate in groups or teams that may impact their information behaviors (Hyldegård, 2006; Sonnenwald & Pierce, 2000; Talja, 2002).

Communication and interaction among group members is both unavoidable and essential if group members are to be successful in achieving the group's goal and purpose (Gouran &

Hirokawa, 2003; Hause & Woodroffe, 2001; Hirokawa, DeGooyer, & Valde, 2000; Poole, 1999). Group process refers to both the exchange of information and ideas among group members and the procedures accepted by group members to conduct the group's task (Hirokawa, DeGooyer, & Valde, 2000). Interconnected and interrelated aspects of group process require interdependence among the members so that group members can collectively accomplish goals that would be challenging or unattainable for a single individual to achieve. This accomplishment can happen only when members are able to count on each other to carry out their roles and responsibilities (Henman, 2003). Many researchers have concluded that this form of interdependence is the nature of "groupness" and thus have built the definition of groups on this aspect (e.g., Fiedker, 1967; Stogdill, 1959). Researchers have offered descriptions of degrees of interdependence in teams (e.g., Cannon-Bowers et al., 1995; Dwyer et al., 1997; Saavedra, Earley & VanDyne, 1993; Salas et al., 1992; Salas, Sims, & Burke, 2005; Wall et al., 1986). Team members interact with tools as well as people. They accomplish the team's goals and objectives through a shared understanding of team resources (e.g. members' knowledge, skills and experiences) and the restrictions the team has to handle. I use team and group interchangeably in this study.

Dervin (1999) regarded information as an interactionally-created artifact, suggesting that researchers move analytic attention away from problems of "access" and towards the ways in which information is developed in the process of collaborative work. Some researchers have recognized information-seeking as a critical aspect of collaborative work activities (Cicourel, 1990; Forsythe et al., 1992; Paepcke, 1996). Other researchers have supported the importance of information behavior for team performance (e.g, Allen, 1977; Kraut & Streeter, 1995; Solomon, 1997; Sonnenwald & Lievrouw, 1997).

Many scholars have observed information behavior in team communication (Hyldegård, 2006). Ancona and Caldwell (1992) examined information flow that occurred in the nature of work relationships. Others have examined the group members' roles in relation to information. Some of these studies investigated the difference between actors outside and inside the group and the complexity to determine where some actors should belong (e.g., Algon, 1996; Paepcke, 1996). Some have developed typologies of actors and their particular roles (e.g., Ancona & Caldwell, 1988; Sonnenwald & Lievrouw, 1997). Paepcke (1996) examined the difference between the kind of information that the members of a group shared inside and the kind of information that was being brought to a group from outside. However, there is little empirical understanding of how individuals find needed information collaboratively (Reddy & Dourish, 2002). These findings are informative to my study in examining the instructor participant groups, in particular group interdependence, communication and information processes as presented in Chapter 8.

3.3 COLLABORATIVE INFORMATION-SEEKING AND SHARING

Similar to individuals, researchers agree that groups process pertinent and acquirable information to perform intellectual tasks (Bazerman, Mannix, & Thompson, 1988; Chalos & Pickard, 1985; Hastie, 1986; Hinsz et al., 1988; Hirokawa, 1990; Larson & Christensen, 1993; Laughlin, VanderStoep, & Hollingshead, 1991; Levine, Resnick, & Higgins, 1993; McGrath & Hollingshead, 1994; Sniezek, 1992; Streufert & Nogami, 1992; Tindale, 1989; Vollrath et al., 1989; Von Cranach, Ochsenbein, & Valach, 1986; Wegner, 1987). I found studies of collaborative information-seeking and retrieval practices within various workplace contexts, such as health care facilities (Reddy & Jansen, 2008; Reddy & Spence, 2008), the military (Prekop, 2002; Sonnenwald & Pierce, 2000), government (Hansen & Järvelin, 2005), people with

HIV/AIDS (Veinot, 2009), medication (Hertzum, in press), design teams in companies (Bruce et al., 2003; Bruce et al., 2004; Poltrock et al., 2003a, 2003b; Sonnenwald & Lievrouw, 1997) and educational settings (Hyldegård, 2006, 2009). Collaborative information-seeking has been studied within the computer-supported collaborative work (CSCW) domain (Twidale, Nichols, & Paice, 1997; Cohen, Maglio, & Barrett 1998; Romano et al., 1999). Some researchers have argued that CSCW researchers have devoted more attention to information flow and transfer in collaborative settings than to the process of collaborative information-seeking (Hyldegård, 2006; Reddy & Dourish, 2002). They emphasized systems design to support the information-seeking activities rather than investigation of those activities (Stein & Maier, 1994; Twidale & Nichols, 1998; Twidale, Nichols, & Paice, 1997). Other researchers have criticized the systems design approach because it is solely concerned with individual users. The systems design approach needs expansion to support collaboration (Foster, 2006; Hansen & Järvelin, 2005; Reddy & Jansen, 2008; Sonnenwald & Pierce, 2000; Twidale, Nichols, & Paice, 1997).

Talja and Hansen (2006) explicitly defined information sharing as a type of collaborative information behavior, which was "a collaborative and interactive process" (p. 114). Talja and Hansen (2006) argued that people actively shared information as much as they sought it, and others agreed (Hansen & Järvelin, 2004; O'Day & Jeffries, 1993; Poltrock et al., 2003a, 2003b; Prekop, 2002; Sonnenwald & Pierce, 2000; Twidale, Nichols, & Paice, 1997).

A few detailed, empirically-based field studies have examined engineers' collaborative information-seeking (e.g., Allen, 1977; McDonald & Ackerman, 1998; Sonnenwald & Pierce, 2000). With a longitudinal nature, these studies showed how social and collaborative aspects as well as the work context affect engineers' information behaviors and the problem-solving process (Hyldegård, 2006). The most well-known example in these studies is likely Allen's

(1977) description of the gatekeeper phenomenon (Hyldegård, 2006; Reddy & Dourish, 2002). A gatekeeper seeks information and shares it with colleagues in the team or organization. Allen suggested that the gatekeeper and recipient of the information collaborated to acquire useful information to their work. Bruce and colleagues (2003) analyzed two design teams at the beginning of a software-engineering project and an aviation-engineering project. Collaborative information-seeking occurred when the engineers were finding, examining, and defining their information problems and forming strategies for information-seeing. But individual members generally retrieved information on their own, rather than collaboratively. Poltrock and associates' (2003a, 2003b) field studies investigated information gathering in two design teams that possessed different products, disciplinary backgrounds and tools. They examined how two design teams looked for information and how they shared the retrieved information within the team. They defined collaborative information retrieval as the activity that a group or team of people performed to identify and satisfy a shared information need, discussed the need, coordinated the information retrieval activities across multiple participants, and shared the retrieved information within the team. Information retrieval activities could be performed collaboratively or individually. The findings were illuminating and insightful to my study of the instructor participant groups. I found that their in-group information processes had some similarities to engineers' processes, but there were differences in forms of collaborative information-seeking. For example, the instructor participants in groups performed more than one form of collaborative information-seeking as reported in Chapter 8.

As Veinot (2009) summarized, Fidel and her associates (2004), Reddy and Jansen (2008) and Reddy and Spence (2008) argued that people might seek information collaboratively in the workplace for several reasons, such as one's own lack of expertise in a special area or a desire for tacit knowledge; lack of immediate accessibility; and decision-making. As a type of collaborative information behavior, information sharing can be understood as a collaborative and interactive process (Talja & Hansen, 2006, p. 114). Talja and Hansen (2006) argued that people share information as much as they look for it. Workers might share information through recommending or forwarding information or contacts to their coworkers (O'Day & Jeffries, 1993; Poltrock et al., 2003a, 2003b; Prekop, 2002; Sonnenwald & Pierce, 2000; Twidale, Nichols, & Paice, 1997), and sharing documents with team members (Hansen & Järvelin, 2004; O'Day & Jeffries, 1993). Some researchers employed the term Collaborative Information Retrieval (CIR) to describe any activity that collectively resolved an information problem (e.g., Dumais et al., 2000). Hansen and Järvelin (2005) proposed that collaborative information activities may focus on either a) documents, such as when people create or use documents together; or b) human beings, where people seek advice or expertise from others (pp. 1110-1111).

Collaborative information-seeking is embedded in work practices (Foster, 2006; Reddy & Spence, 2008), and various collaborative information behaviors have been documented in prior studies, including: communicating and consenting shared information needs (Poltrock et al., 2003a, 2003b); posting questions and providing answers (Hansen & Järvelin, 2005; Poltrock et al., 2003a, 2003b; Prekop, 2002; Reddy & Spence, 2008; Twidale, Nichols, & Paice, 1997); joint team searching (Twidale, Nichols, & Paice, 1997); delegated or coordinated searching (O'Day & Jeffries, 1993; Poltrock et al., 2003a, 2003b; Prekop, 2002; Twidale, Nichols, & Paice, 1997); using information systems and sources during collaborative, problem-solving conversations (Crabtree et al., 1997; Reddy & Jansen, 2008; Sonnenwald & Pierce, 2000); producing prototypes for feedback (Poltrock et al., 2003a, 2003b); and holding or attending group meetings

(Poltrock et al., 2003a, 2003b). Some of these behaviors were identified in the instructor participant groups, as discussed in Chapter 8.

There is growing research interest in collaborative information-seeking and sharing within workplaces and academic settings (e.g., Hansen & Järvelin, 2005; Prekop, 2002; Reddy & Jansen, 2008; Sonnenwald & Pierce, 2000; Talja, 2002; Talja & Hansen, 2006). Numerous organizational psychologists have theorized about tasks and work groups (Arrow et al., 1996; Gersick & Hackman, 1990; McGrath, 1984; McGrath & Arrow, 1995-6), but to date the relationships between them have not been strictly studied (Algon, 1996, p. 206). Hinsz, Tindale, & Vollrath (1997) pointed out that the field of human communications provided theory and research that made a strong case for a number of relations between communication and information processing in groups (Ellis & Fisher, 1994; Hirokawa & Poole, 1986). Examples include structuration theory of small-group communications concerning how group members develop collective representations of a group task (Poole, Seibold, & McPhee, 1986; Poole & Doelger, 1986) and transactive memory processes (Wegner, 1987), referring to communication processes between group members that serve to share and exchange remembered information.

3.3.1 Transactive Memory System (TMS)

The transactive memory system proposed by Wegner (1987) and several other theoretical frameworks of group knowledge processes tried to understand how groups could better coordinate and use their available expertise to solve unique and complex problems. Wegner was the first to examine transactive memory and considered it to be a shared system of encoding, storing, and retrieving information from different domains of knowledge that often developed in close relationships (Wegner, 1987, 1995; Wegner, Giuliano, & Hertel, 1985; Wegner, Erber, & Raymond, 1991). Wegner’s (1987) definition of TMS covers two key elements: (a) a combination of individual knowledge and (b) interpersonal awareness of others' knowledge. Wegner (1987) suggested that a transactive memory system could develop within the group as a group-level phenomenon (Lewis, 2003). Wegner (1995) proposed that knowledge specialization was greater in groups with well-developed transactive memory systems. Most researchers agree that the basic components of TMS consist of specialization, coordination and credibility (Ilgen et al., 2005).

Effective group performance depends on the ability of the group to access, communicate and use accurate information held by its individual members. The potential benefits of transactive memory for work group performance are clear (Moreland & Myaskovsky, 2000). It enhances group coordination (Murnighan & Conlon, 1991; Wittenbaum, Vaughan, & Stasser, 1998) and solves problems faster and more easily (Moreland & Levine, 1992). Some research indicates that recognizing experts and determining the most accurate member in the group leads to superior group performance (Henry, 1995; Littlepage, Robinson, & Reddington, 1997; Stasser, Stewart, & Wittenbaum, 1995) because it offers quicker access to a larger amount of knowledge, improves information integration (Cannon-Bowers & Salas, 2001) and decision-making processes (Stasser, Stewart, & Wittenbaum, 1995), and affects the team members' perception, satisfaction and identity within the team and the organization (Michinov et al., 2008). Positive benefits of TMS on the instructor participants' collaborative information-seeking and sharing are demonstrated in Chapter 8.

The use of transactive memory analysis is examined in many studies, for example in intimate relationships (Hollingshead, 1998a, 1998b; Wegner, 1995, Wegner, Erber, & Raymond, 1991; Wegner, Giuliano, & Hertel, 1985), health behavior (e.g., Pennebaker, 1982; Sackett & Snow, 1979), the medical community (Faraj & Xiao, 2006; Michinov et al., 2008), instructional psychology (e.g., Johnson & Raye, 1981), organization management (Wegner, 1995) and team performance in the laboratory (Moreland, 1999). Researchers have extended the TMS concept to workgroups (e.g., Liang, Moreland, & Argote, 1995), but there are not many studies of workgroups (Austin, 2003). Other studies found indirect evidence of transactive memory systems that influenced information exchange and group decisions (e.g., Hollingshead, 1998c; Liang, Moreland, & Argote, 1995; Moreland, Argote, & Krishnan, 1996). Such research relied on data from laboratory groups (e.g., Hollingshead, 1998c, 2000) or newly formed groups (e.g., Moreland, 1999). Transactive memory systems are especially important for teams designed to leverage members' expertise (Hollingshead, 2001; Lewis, 2003; Wegner, 1987). No empirical studies have yet demonstrated TMS in the fire service and its role in fire service field staff instructors' information-seeking and sharing.

The research findings from both group interdependence and collaborative information-seeking and sharing informed the design and data analysis of this study of information-seeking process and sharing in groups. This scholarship assisted in exploring how group interdependence and collaborative information-seeking and sharing affected the instructor participants' information behaviors, how the roles that group members played related to their information search and use, and how individual instructors collaborated to find information they were looking for.

3.4 CONCLUSION

According to Case (2007), recent investigations of engineers' information-seeking made attempts to examine the process using contextual, situational or role variables rather than the usual demographic variables. These studies were concerned with sources and channels, especially interpersonal channels. One common result was that engineers still looked for people for information. Researchers continued asking the same question about the information needs and uses of professionals: “Who or what do people consult for information?” (Case, 2007, p. 283).

Although new studies are emerging on collaborative information-seeking and retrieval, there are still more questions than answers. Few studies have brought together individual and group efforts and treated them as one integrated behavior in the process of information-seeking and sharing. There are also new studies on specialized groups. However, despite the obvious importance of information practices and information-seeking behaviors in the fire service user group, a review of the literature found no study that specifically looks at fire service instructors as information gatherers, or that documents their information practices, and provides a preliminary examination of methods and methodologies to study their information use, information-seeking and information sharing behaviors. This is a neglected area of research and this study attempts to fill in the gap.

CHAPTER 4

METHODS

The nature of qualitative data analysis is inductive, so it is important to document the steps, instruments, techniques, and measurements used to reach findings (Miles & Huberman, 1994; Wang, 1999). In this chapter, I share descriptions and explanations of my qualitative research procedures and the methods I used in data analysis to report my interview experience.

4.1 MY PREVIOUS WORK

Fire service responders played heroic roles fighting the terrorist attacks on September 11, 2001. In the aftermath of the event, there has been an increased awareness of the need to understand fire service responders' information practices and information-seeking behaviors. It stands as a compelling domain in need of innovative information services and programs to meet the dynamic demands of the job in a timely fashion. To begin contributing to this important area, I carried out two research projects:

The first project, with co-author Professor Linda C. Smith, was entitled *A Survey to Support "Evidence-Based Practice" in Special Libraries Serving Fire Service Personnel and Researchers in Public Safety and Homeland Security Areas* (Ruan & Smith, 2003). Employing evidence-based research practices of the Special Libraries Association (2001), the objective of this research was to determine how special libraries serving fire professionals were used and valued. The project studied whether the libraries were efficiently organized to give maximum access to their resource collections and the impact such libraries had on fire professionals' information use and decision-making. A survey was administered to fire professionals (including fire service personnel as first responders and researchers) in six fire libraries that represented significant contributors of information services in the United States. The study used the Chicago, Rochester, and SLA study instruments as the basis for questionnaires to measure the impact of library-supplied information on practical decision-making and applied research in the fire emergency services.

Major findings indicated that 97% of the fire service personnel and researchers (n=343) said that the information received was relevant to their work. 97% reported that the information was of practical value, and 81% said that the information was of research value. The special libraries were effective in supplying information in decision-making situations because 94% of respondents reported that the information they received led to better-informed decisions and to an increase in their level of confidence in those decisions (89%). Areas of impact included training, research, emergency response, changed procedures and policies, budget decisions and personnel management. The study demonstrated the vital and integrated roles fire service libraries could play in their organizations, as information services had a direct impact on users' training, research and emergency response activities. Future research was suggested. The SLA Steven I. Goldspiel Memorial Research Grant and the Campus Research Board at the University of Illinois at Urbana-Champaign funded the project. The research findings, entitled "Evidence-Based Practice in U.S. Fire Library Management" were also published in *The 2007 Evidence Based Library and Information Practice Conference (EBLIP4) Proceedings* (Ruan & Smith, 2007).

The second survey project in 2007 was "Information Use and Needs of Field Staff Instructors" of the Fire Academy. The sample consisted of 474 field staff instructors throughout the state. The purpose was to understand their information needs and uses along with their information-seeking behaviors. I also hoped to capture the type of information environment that would best support their activities and help clarify the Fire Academy Library's priorities of information services and programs that were responsive to the dynamic context of their information needs. I received 126 responses with a 27% return rate. The questionnaire was divided into the following categories: Demography, Professional Associations, Roles and Tasks, Gatekeepers, Technologies, Electronic Sources, Teaching, Publications, Reading, Personal Subscriptions to Journals, Types of Information and Information Resources and the Library and You. Data analysis was completed and most of the findings are presented in graphic charts. Key results of this survey are presented throughout this study.

Both studies directed my attention to information practices and information-seeking behaviors of fire service instructors and indicated that more in-depth qualitative investigation was necessary to understand their unique, dynamic, and complex information practices and information behaviors. My experience with the previous studies informed the design of this project. From a methodological standpoint, they confirmed to me the need for qualitative interviews for a better and fuller understanding of the information needs of fire service instructors. They also provided me with preliminary data from which to build. My early investigations suggested that there were certain types of interactions and activities common to field staff instructors at the Fire Academy. Some of the unexpected findings from my preliminary work, later confirmed in this study, helped me maintain a broad view of the problem. For example, three particularly surprising patterns surfaced from this study. First, I had assumed that the field staff instructors would be quickly satisfied by “good enough information,” and their search for information would not be deep and wide. I had also expected that they would focus on one subject expertise and would not turn to other subject areas when they looked for information. I had thought that they would be doing frequent information-seeking and sharing alone. We will see how my assumptions fared in this study’s findings in the later chapters.

4.2 QUALITATIVE INTERVIEWING

In order to more fully explore human behavior, library and information science researchers increasingly utilized the method of qualitative interviewing in the 1980s and 1990s. It holds a noticeable place among research methods (Mishler, 1986) and is a popular methodological tool of the qualitative researcher (Denzin & Lincoln, 1998; Miles & Huberman, 1994). The interview method permits thorough discussions with the participants and gives informative and rich data that often discloses thoughts and reasons underpinning behavior (Fontana & Frey 1998; Gray, 2004; Warren, 2002). The interview method is important to research designs for investigating behaviors that depend on context (Rubin & Rubin, 2005). It helps convey people's implicit perceptions, feelings and understandings (Arksey & Knight, 1999; Cohen & Manion, 1997). It helps researchers to comprehend others' experience and the meaning they make of that experience (Seidman, 1991). Patton (1990) argued that "a good interview laid open thoughts, feelings, knowledge and experience not only to the interviewer, but also to the interviewee" (p. 353). As Miles and Huberman (1994) suggested, one of the main features of qualitative data is "their richness and holism, with strong potential for revealing complexity; such data provide 'thick descriptions' that are vivid, nested in a real context, and have a ring of truth that has strong impact on the reader" (p. 10). LIS studies of information-seeking in everyday life often use qualitative approaches (Case, 2002).

This study concentrated on describing and explaining the complexity of the information environment in which fire service instructors worked, their information practices, individual and collaborative information-seeking and sharing behaviors, sources of information and factors that influenced their use of information. There are a number of possible methodological approaches to studying information-seeking and sharing behaviors of field staff instructors. Like the existing qualitative work in user studies, my questions about their information behaviors were best explored through a qualitative interview approach. My choice of method was primarily dependent on my previous work, the objectives of this research and the research questions listed above. In addition, here are other key reasons why I decided to use the interview method to study field staff instructors' information behaviors:

Interviewing was well-suited to studying behaviors of field staff instructors that were context-dependent. It could be used to gather information about field staff instructors' instructional activities, typical problems, information sources, group work, obstacles, world view, work theory and the meanings that underlie their information behaviors. Interviewing could be used to identify variables and their relationships in order to examine and expand Leckie's model of information-seeking of professionals.

Among major advantages of interview studies proposed by Bailey (1994), the following reasons were uniquely critical to my study due to the nature of field staff instructors' work practices and their physical dispersal in locations throughout the state. Although follow-up emails were sent as needed, all interviews were completed during one session with the instructor participants, following my interview guide (see Appendix H).

1) Flexibility. I was able to probe the instructor participants for more specific answers and to repeat a question when their response indicated that he/she misunderstood me or I needed more explanation.

2) Nonverbal behavior. I was able to observe nonverbal behavior during face-to-face interviews and assess the validity of a field staff instructor respondent's answer.

3) Control over environment. I standardized the interview environment by making certain that the interview was conducted in a private office.

4) Question order. Although I had a list of issues and questions to be covered, I did not deal with all of them in each interview. The order of questions also changed depending on the direction of the interview. As the interview unfolded, I asked additional questions if new issues arose. Probing allowed the interview to divert into new directions, which I did not originally plan as part of the interview and helped me better meet the research objectives.

5) Spontaneity. I recorded field staff instructors' spontaneous answers.

6) Completeness. I was able to ensure that all of the questions I asked were answered.

7) Time of interview. I was able to record the exact time, date and place of the interview. Thus if some emergency event had occurred during the course of the study that might cause changes in the instructor participants' answers, I would have been able to compare answers before and after the event. Fortunately, no emergency occurred.

8) Greater complexity of questions. My interview guide was more complex than a survey questionnaire, like my 2007 survey questionnaire, with additional questions to better explore the instructor participants' experiences.

Selecting interviews as a method was appropriate for this study also because it sought to discover and welcome critical factors that impacted the instructor participants' information-seeking and sharing behaviors. My interview permitted open-ended investigation of topics and presented responses that were tacit in the unique words of instructor participants, rather than attempting to make each participant fit in a pre-defined format with prejudice. Interviews helped me acquire information that the individual probably would not unveil by any other data-collection method (Gall, Gall, & Borg, 2003), and this allowed surprising factors to emerge.

Hackman (1990) warned that studying a group is not easy. Group theory in general focuses on groups as accepted and bounded entities within an institution that are organized by that institution and its perspective of tasks (Hackman, 1990). People generally explain, retain and articulate their group experiences narratively (Fisher, 1984). Given the complexity of fire service groups, I utilized open-ended questions to get individual instructor participants to elaborate on their group experience and its influence on their information-seeking and sharing behaviors.

Interviewing has a wide variety of forms and a multiplicity of uses (Rubin & Rubin, 2005). Gray (2004) divided the method into categories ranging from the informal conversational to the completely structured, also including semi-structured, non-directive (unstructured) and focused interviews. The choice of interview technique depends in large part on the aims and objectives of one's research, with structured interviews drawing more quantitative data and unstructured or focused interviews generating qualitative data (Gray, 2004). The semi-structured interviews approach asks structured questions and then probes deeply using open-ended questions to obtain additional information (Gall, Gall, & Borg 2003). This approach permitted me to collect rich data in a limited period of time and was best used in this study because of its small scale (25 participants). The main questions guided the conversation between the instructor participant and me on the topic. Semi-structured interviews allowed me to use a combination of open- and closed-ended questions to "probe" for more detailed responses in which the instructor participant was asked to clarify what he/she said and elaborated on the answers. As new issues arose, additional questions were asked, including some which were not anticipated at the start of the interviews. Attaining highly personalized data and having opportunities for probing through the interviews proved to be vital to this study. I documented participant responses by tape-recording the interviews and taking notes.

It was essential to frame balanced and meaningful interview questions (Charmaz, 2002) for my study. I developed the interview question guide around the basic research questions outlined at the beginning of Chapter 1. My previous studies helped me determine effective questions, and the interview guide was designed to direct the conversation while allowing for flexibility. I had a list of issues and questions to cover (see the interview guide in Appendix H). Each interview began with introductory questions intended to elicit responses from instructor participants concerning their information activities in the course of teaching, training and curriculum development. These early questions further contextualized the unfolding conversation between the instructor participants and me. The first question was the most open-ended, and often the instructor participant’s answer was the longest. I asked the instructor participants to describe the subject area they worked in, in order to gain a better understanding of it for myself and to get them talking freely about their work. My rapport with participants came readily, and the interview relationship was often strong across cases. The subsequent questions comprised the heart of the interview and were intended to tease out and explore the process of teaching, training and curriculum development and associated information-seeking and sharing behaviors. Those questions led instructor participants and me naturally into a discussion about their reflections on their experiences, noting the particular activities, places, problems, types of information, interaction with group members and meanings in the process. I encouraged instructor participants to elaborate on topics they were eager to talk about. I completed each interview with a concluding question that was more summative in nature and offered instructor participants the opportunity to express their own questions and to talk over anything they believed was missed in our conversation. At the start of the interview session, I obtained a sense of the context, the actors and how the process of instructional work seemed to work locally. From that knowledge, I strove for a deeper and broader understanding.

Table 5 below summarizes how those interview questions were designed to collect data in order to answer the research questions and relate to Taylor and Leckie's models.

Table 5. Interview Questions Designed to Answer Research Questions

Research Questions	Interview Questions	Taylor's IUE Model	Leckie's Model
1. How do fire service instructors, in particular the Fire Academy's field staff instructors, organize, work and perform their training, teaching and curriculum development? 2. What views of the world and theory of work inform their instructional activities?	1. Tell me about your training and teaching activities at the Fire Academy. Describe and explain how you do them. 2. Describe a recent curriculum development project at the Fire Academy in which you were engaged. Please describe enough details so I can understand your process on how you did it.	Sets of people Typical setting	Work Roles Associated Tasks
3. What are the typical problems that lead them to engage in information-seeking while they are involved in their training, teaching and curriculum development activities?	3.1 Describe the most difficult aspect of your training and teaching as an instructor. How did you convey the Knowledge, Skills and Affective of your class to your students? 3.2 Describe the most difficult aspect of your most recent curriculum development project. 5. Have your information-seeking problems changed over time? If yes, do you account for the change, i.e., because of your daily routine (training, teaching, curriculum development and actual emergency response) or because sources of information have changed? Give specific examples.	Typical structure and thrust of problems	Characteristics of Information Needs

Table 5 (cont.)

Research Questions	Interview Questions	Taylor's IUE Model	Leckie's Model
4. What kinds of information sources do they look for and where, to solve these information problems?	6. Do you rely on any particular a) Experience, b) People, c) Personal collection as top sources for your teaching, training and curriculum development? 7. How particularly helpful and important is experience to your training, teaching and curriculum development, including your own experience, other instructors' and students' experience, in classroom lecture teaching and hands-on skill training? 8. What types of information materials do you seek and use to resolve the typical problems and make decisions about your training, teaching and curriculum development project? Give specific examples, e.g., experienced instructors and officers, books, videos, magazines, etc. 9. How do you decide that you have enough information? 11. What would be your recommendation to someone who is starting similar work of training, teaching and curriculum development so that they would increase their chances of finding relevant information?	Resolution of problems	Source of Information Awareness of Information Outcomes Feedback
5. How does collaborative teamwork affect an individual field instructor's information-seeking behavior?	10. Think about a most memorable experience of curriculum development group work that affected your information-seeking. Be sure to tell me about makeup of the group that was involved, what kinds of information were sought, and where did you look, how you knew the information found was helpful to the group's performance. Please relate as many details as possible.	Sets of people Typical setting	Characteristics of Information Needs Source of Information Awareness of Information Outcomes Feedback

Table 5 (cont.)

Research Questions	Interview Questions	Taylor's IUE Model	Leckie's Model
6. What obstacles do they perceive in the search for and use of necessary information during the course of their work?	4. What obstacles are typical to your training, teaching and curriculum development work? Give specific examples.	Typical setting	Source of Information Awareness of Information Feedback

As Table 5 shows, in the interviews I elicited information about the practices and strategies the instructor participants used to collect and use information and the conditions that influenced that process, with most questions related to the Taylor and Leckie's models, and provided validation to the models as a useful framework to develop interview questions. Additional data offered new dimensions and aspects of instructor participants' information-seeking and sharing behaviors. Research question two on instructor participants' views of the world and theory of work was directly associated with the RPD model. I invited both directors at the Fire Academy to review my study proposal. I had carefully pre-tested my interview questions, designing them to avoid the dangers of compiling data through questions that articulated my assumptions rather than derived from instructor participants' experiences in their words (Charmaz, 2002). I did a pilot interview session with one of the directors during my proposal development stage. He reviewed, answered and commented on all interview questions.

4.3 SAMPLING AND PARTICIPANTS

The sample was selected with purpose and strategy in mind as shown in Table 6. I worked with a highly purposeful sample that provided a depth of understanding that could not have been obtained by interviewing random instructors. I adopted a criterion sampling strategy, which meant that all cases met criterion and parameters, and the cases were useful for quality assurance (Miles & Huberman, 1994). The selection of informants was also driven by research questions and conceptual frameworks not just by a concern for "representativeness."

Table 6. Sampling Parameters and Choices (Adopted from Miles & Huberman, 1994, p. 30)

Sampling Parameters	Choices
Settings	Fire Academy, other teaching and training sites and scenes
Actors	Field staff instructors with different characteristics (e.g., rank, seniority, experience, specialization, education, etc.)
Events	Teaching and training the Fire Academy's classes, writing, updating and revising curriculum projects
Process	Teaching, training and curriculum development

The nature of my research questions required that the field staff instructors had all been actively involved with the Fire Academy's curriculum development project(s). Not every field staff instructor has curriculum development experience. To seek a group that reflects a variety of important variables, I developed the Fire Academy's Field Staff Instructor's Profile to assist in selecting the potential participants with diversity across time, space, specialty domains and organizations based on the following inclusion criteria (see Appendix I):

- Instructor participants came from different geographical locations in the state.
- They represented different types of fire departments (e.g., career, paid, paid-on-call, and volunteer fire departments).
- They had been involved with different types of programs and projects in teaching, training and curriculum development.
- They represented a mix of demographic and background data in terms of work/teaching experience, ranking, education level, specialty, age, gender, and communication tools.

I also used *the Fire Academy Library's Borrower Database* to obtain the potential participants' demographic and background information. Additional resources were consulted, such as the Director and Deputy Director, and the Office of the State Fire Marshal's listing of Fire Departments. Prior to the interview, I was able to collect approximately 80% of the data for the profile. The instructor participants were recruited primarily using this information. The remaining information for the profile was obtained from the instructor participant before (and after in some cases) the interview started.

Those variables represented key diversity and range of the field staff instructors and information situations that existed in the fire service community. The sampling approach helped me to examine qualities brought out by different cases and document the variations associated with different conditions. Detailing the many specifics of the field staff instructors added a unique flavor and richness to the context of the study.

4.4 RECRUITMENT

Twenty-five field staff instructors from the total 474 field staff instructors throughout the state were selected and recruited to participate in the study, based primarily on the instructor participants' profiles. I worked closely with the Fire Academy directors to determine potential candidates, since they knew the instructors well. I also drew on the instructors' background information from the Fire Academy and the Library databases to supplement the profile as needed. I found that the field staff instructors who met the inclusion criteria of involvement with different types of programs and projects in teaching, training and curriculum development were rarely from volunteer fire departments in small towns and rural areas, especially in the south region. Twenty of them work for paid fire departments, with three paid-on-call, one volunteer and one combined, all in urban areas located in east, west and north regions of the state. All of the 25 instructor participants provided a rich and fascinating pool of participants. Although the field staff instructors differed somewhat by geographical location, level of experience and skills, the analysis showed that they were remarkably consistent in some areas, for example, teamwork in "gang" teaching and training. There were also differences expressed, for example, between subject areas of firefighting and hazardous materials.

A careful follow-up recruiting plan with considerable time and effort was developed and implemented. I sent each potential participant an invitation letter with the Information for Interview Participants (see Appendix J). I followed up with phone calls, emails and face-to-face meetings (while they visited the Fire Academy) to schedule an interview appointment.

After identifying 35 field staff instructors and interviewing 25 of them, I ended the data collection, since I reached "saturation point," when no more new data can be extracted and added.

4.5 CONSENT PROCESS AND DATA COLLECTION

Following suggestions in Miles and Huberman (1994), I paid close attention to focus and bounded the collection of data **--** learning to reduce it in advance. I constantly consulted Table 5 to use systematic conceptual frameworks to organize variables and their relationships. I often used research questions to further define the objects of inquiry. I defined the "heart" and boundaries of my study through a careful sampling plan, as discussed above. At its core, the study was conducted in an effort to gain better understanding with a first-hand look at fire service field staff instructors' information-seeking and sharing behaviors associated with their instructional activities.

I prepared the promotion packet and information sheet in both electronic and hard copy versions (see Appendix J). I guaranteed anonymity and confidentiality of the data and encouraged instructor participants to be frank and open in their responses and interviews. Each instructor participant was asked to sign the consent form in print and received a copy for his/her own records before the interview started. I encountered no challenge in gaining cooperation and response from instructor participants.

I collected data from the instructor participants in the following stages.

1) All instructor participants were asked to schedule an approximately 60- to 90-minute interview session at the Fire Academy or by telephone. The interview was scheduled at a time that was convenient for both the participant and me while he/she visited the Fire Academy or by phone. In all but a couple of meetings, the sessions ran more than 90 minutes.

2) Each instructor participant was provided with a consent letter approved by the Institutional Review Board (IRB) of the University of Illinois (see attached in Appendix K.1), and an information sheet that gave them background information on the study, including my email address and a telephone number where I could be reached, a brief description of the project's goals, its voluntary nature and what it asked of instructor participants (see a copy of the project information sheet in Appendix J). An outline of questions for the interview was available upon request by the instructor participant. Prior to the interview, the consent letter was emailed as an attachment. Reviewing and securing signatures for informed consent was the first activity performed before the interview began and included approval of audio recording. None of the participants indicated discomfort with the recording procedure. During my communication with the instructor participants, I emphasized the voluntary nature of the project, confirmed that they met the sampling inclusion criteria and explained more fully what the study was about and the conditions of remuneration. I also asked the instructor participant to go over the profile with me

to add any missing information. It took about ten minutes to review the informed consent paperwork and the profile.

3) I conducted my first interview on January 27, 2009, continued recruitment contacts, and finished the last interview on March 17, 2009. The Fire Academy's strong in-house support and the instructor participants' enthusiastic cooperation made it possible for me to schedule interview appointments one week after another smoothly with little interruption. Over the data collection period of more than two and one-half months, I had 35 field staff instructors expressing potential interest in the study. The majority of them communicated with me by email. Of the 35 field staff instructors, 22 eventually met with me in person and three by telephone. Although I anticipated the possibility of being overwhelmed with potential interests, that situation never occurred. Of 25 (N=25) field staff instructors who volunteered for the study, I sent follow-up emails with questions to 17 of them to further clarify some statements they made during the interviews. Prior to the interview, I had a file folder to represent each instructor participant, labeled with a unique code number.

My face-to-face conversations with the instructor participants most commonly occurred in a private office at the Fire Academy. The interviews were scheduled in either the morning or early afternoon hours. Typically we would settle into chairs and I would arrange the audio- and digital-recording system on the desk. I read aloud each question and then the instructor participant answered it accordingly. As we worked through the questions together, instructor participants were allowed to ask any questions and/or clarify any confusion. I encouraged the instructor participants to tell their own stories as specifically as possible about how they conducted teaching, training and curriculum development. I was most concerned with their information behaviors, so I wanted accounts of what the instructor participants did and what they perceived to be important. The self-description data collected for this study highlighted the practices, problems and situations as perceived by the individual instructor participants. Such perceptions illustrated their world through their lenses and in their words, which is precisely what I was targeting.

4) Each interview, including the three conducted over the telephone, was recorded on a digital-audio recording system. For each interview, I would use the first two minutes to test the recording system to ensure every word would be recorded successfully. Digital voice files were then copied onto a hard drive and backed-up to another drive for archival purposes. These files will be maintained for a minimum of three years for analysis and are secured to protect instructor participant confidentiality. During the discussion, I took notes and jottings on the content of the conversation and overall flow of the session. In particular, I was noting instances when the instructor participant mentioned information-seeking and sharing activities. When the instructor participant brought out something critical, I asked to talk more about it. Instead of stopping the conversation and possibly getting sidetracked when I had a question, I made a note and then reminded him/her to show or explain it when we finished the interview.

5) When the interview ended, I often reviewed my notes with the instructor participant to determine additional things to examine or to add things I overlooked or missed. The digital-recording system remained running until the last minute that the conversation stopped. At the conclusion of the interview, I gave the instructor participant the remuneration, a gift certificate of $25 for a local restaurant he/she chose, along with a short handwritten thank you message from me.

6) The clear goal of my interviews was to understand instructor participants' views, their unique personal experiences and situations. Both instructor participants and I made active

contributions to elicit narratives and generate meaningful descriptions. The set of interview questions I originally developed prior to the start of data collection was fairly comprehensive and served as an effective guide. I changed the order of questions slightly after I met with some of the earliest instructor participants to derivate richer and more thoughtful descriptions. Although I worked from the same set of interview questions over the course of my interviews, I did not ask all instructor participants the same questions in the same order. In some cases, questions were added, raised differently or dismissed entirely. Preparing the profile ahead of each interview proved to be beneficial in this concern. Having an overall sense of instructor participants, their experiences in teaching, training and curriculum development prior to the start of the interviews assisted me in organizing my thoughts and prioritizing the interview questions. The instructor participants' descriptions about the Fire Academy and the work performed there gave me a better comprehension of their activities and group associations that are part of their instructional process.

7) Follow-up questions for clarification by email helped me trace the implicit answers to interview questions provided by the instructor participants and further teased out critical themes, concepts and ideas for data processing and analysis. Their response to these questions was timely. The answers were added and coded.

The semi-structured interviews I conducted posed some challenges in the early stages as I learned how to conduct an interview and use the digital-recording equipment system more skillfully. As time passed, my interviewing skills improved, and I worked diligently to communicate with the instructor participants in ways that made sense to them. Instead of using LIS jargon words, I asked them about "who or what they looked for" when they had questions about their information needs. Although it was the first time for all instructor participants to be interviewed this way, they answered my questions thoughtfully, reflected upon what they did and who they were thoroughly, described their work passionately and shared their worlds with me openly.

Besides semi-structured interviews, the materials-based interview is another approach to qualitative data collection (Brockman et al., 2001). Materials-based interviewing helped me examine the inner relationships between problems generated by tasks and information-seeking and how information sources assisted in solving these problems. I used various documents in interviews, including curriculum developed by the interviewee, as a point of entry.

The data collection, processing and analysis of the audio- and digital-recorded interviews and other supplemental materials for this project were overlaid and interwoven.

4.6 SOURCES OF DATA

Over the course of the data collection, analysis and writing processes, I generated a range of materials that served to support both the conceptual framework and documentation of the research process.

The audio- and digital-recordings of the semi-structured interviews were my primary data. Besides written responses to the field staff instructor's profile, I collected documents, such as curricula, lecture notes, curriculum development procedures (see Appendix L) and curriculum design process forms (see Appendix M).

Combining interview data with secondary data is common (Denzin & Lincoln, 1998; Miles & Huberman, 1994). I generated secondary data in the form of interview notes, jottings, memos, and diary as well as documents by the Fire Academy, to supplement and enhance the primary project data generated through the semi-structured interviews and observations. The secondary data helped me remedy the shortcomings inherent in using only one interviewing technique alone and verify data gathered through interviews, since instructor participants' recollections were not always accurate or complete.

I wrote memos during the data collection and data analysis stages for record keeping and documentation. Strauss and Corbin (1998) defined memo writing as the researcher's record of analysis, thoughts, interpretations, questions and directions to guide future fieldwork and data collection efforts. This process helped me become more focused on the theme or construct and made cross-case analytic effort go smoothly (Miles & Huberman, 1994).

To evaluate how the interview was carried out, I kept a diary of my interview experience for each participant by asking and answering questions to help me clarify concepts and set priorities for data collection (Miles & Huberman, 1994). I realized that the sampling choices at the start of the study might not be the most pertinent or data-rich ones. The diary approach helped me conduct a constant systematic review of my interview, sharpen my sample choices in a timely manner and provide implications for revision and updates of my code scheme. Data generated in the diary were incorporated into data processing and analysis. I asked questions to keep myself in check. For example, did I ask the right questions?; did I fail to probe for more detailed information or examples?; are the data I collected today shedding light on the research questions I am trying to answer?; what were the main concepts, themes, patterns, issues, and questions that struck me as important and illuminating in this interview?; what new questions would I have in the email follow-up and the next interview?

Devault (2002) suggested that eliciting accounts and producing meaningful descriptions of participants' experiences and activities needed deliberate attention to language and naming, categorization and concepts, and listening and speaking during the interview process. My jottings, interview notes, diaries and memo writing helped me closely follow Devault's suggestions. My "confessions" through interview notes, diaries and memo writing became very valuable during the data processing and analysis stage. I was clearly aware of what was going on in the interview site and of my own feelings, reactions, insights, and interpretations (Patton, 1990). Interview notes (scribbles and jotting notes) taken on loose-leaf paper were typed up, saved, and organized by participant folder. These notes provided useful data for the final analysis and writing stage. I drafted additional figures and matrices that reflected my developing understanding of variables and relationships among the data I collected, as well as the conceptual frameworks I applied in the analysis. In particular, my analyzing and organizing of variables in matrices suggested by Miles and Huberman (1994) proved to be effective for data analysis, interpretation and expansion of Leckie's model.

Data from observations of three instructor interviewees served as a supplement to interviews (see Appendix K.2). Initially, I did not consider observation, but I was invited with one instructor's enthusiasm during the interview. By taking notes, I observed how he taught with his team instructors in the classroom and how he conducted hands-on training. I found strong confirmations of interview data from the observation. I later observed two other instructors' classes held at the Fire Academy. Documents collected during observations of some of the courses they taught were kept in folders organized by purpose.

I processed and analyzed the data as I collected it, using early insights to inform upcoming interviews and generating different kinds of data through different approaches during each interview. This process helped me capture information as fully as possible on the single meetings I had with instructor participants. I used ATLAS.ti, 6.0, a qualitative analysis software application, for organizing and analyzing both primary and secondary data.

The following table summarizes my sources of data. Over the course of data analysis and writing, some secondary data continued to develop in pertinence, while others eventually lost their importance and were hardly useful.

Table 7. Sources of Data

Data Type	Source of Data
Primary Data	. Semi-structured interviews on audio- and digital-recordings
Secondary Data	. Field staff instructors' profiles . Interview notes and jottings . Memo writing . Documents (curricula, lecture notes, curriculum design form and procedure, etc.) . Diary of interview experience . Observation of classes taught by interviewees . Sketched figures and tables

Preliminary codes drove my ongoing data collection (Miles & Huberman, 1994, p. 65). I performed the coding shortly after the first interview. I often coded the previous interview and the set of secondary data before the next interview started. A starting list of codes was generated. My early data coding helped reshape my outlook, refine my next interview, and clarify any incomplete data so I could do a follow-up. That work continued hand-in-hand with my interviews over the next two and a half months. I began in-depth data analysis shortly thereafter.

4.7 DATA PROCESSING AND DATA ANALYSIS

Data produced by each interview helped me understand the individual case and compare cases in the whole project dataset. All interviews on the audio- and digital-recordings were fully transcribed into verbatim texts and analyzed. The other materials were used as important supplemental data and documentary evidence. I carefully trained four hourly graduate students on transcription. I also used Dragon Naturally Speaking 10 (preferred version) software to do transcribing. Most interviewees were asked to come to my office to follow the software to get their voices trained and recorded. Then the software transcribed the recorded interviews. Only 14 interviews were able to be transcribed using Dragon, half of them with 50% accuracy, five with less than 50% and only two with 95% accuracy in terms of the interview content. Dragon transcribed the other 11 interviews with overwhelming errors. The students and I had to review all transcriptions transcribed by Dragon and make corrections as needed. The Fire Academy's archivist helped with certain difficult elements in words, names or phrases. We transcribed any parts of the conversation that were difficult to recognize on the recordings with brackets, e.g., [fire]. We made a note of other valuable aspects of the conversation in parentheses, e.g. the affiliation expression (smile) or tone (laughing). To protect anonymity, I used initials to represent instructor participants in the transcriptions and concealed other potentially identifying information through the use of similar abbreviations.

The instructor participants' profiles were recorded and compiled on a single spreadsheet. I labeled all documents, using the same unique code I had earlier assigned to each participant. Important handwritten interview notes, jottings, memo writing, diaries, etc. were typed up in electronic form for storage and coding. All documents were integrated within the overall project dataset.

The instructor participants' answers to the questions were confidential and voluntary. To protect the privacy interests of subjects, no names or other identifying information of any participants were included in the interviews, audio- and digital-voice recordings and transcripts. A data key connected participant names to a unique identifying number to be used while data was being extracted from audio- and digital-voice recordings and analyzed. For coding of data, only aggregated data and findings were reported. Other identifying information shared during the interviews was linked with those codes and/or other abbreviations. All supplemental data were labeled with those codes as well. I organized them by themes, concepts and categories, and integrated them with the overall project dataset.

Qualitative research depends heavily on ongoing analysis, and coding is a good device for supporting that analysis (Miles & Huberman, 1994, p. 66). Faced with large amounts of qualitative materials, coding data served as my basic analytic process. Coding the qualitative component of instructor participants' interviews turned out to be complex and exploratory in nature, and surprisingly time consuming. I used codes as "tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study" (Miles & Huberman, 1994, p. 56). Coding itself was analysis, and it forced me to tie research questions and conceptual frameworks directly to the data. I labeled data with various descriptive words and phrases, disassembled data, classified the types of questions asked and answered, conceptualized and integrated data to explain meaning, and identified and characterized the patterns of information-seeking and sharing behaviors of field staff instructors.

In analyzing my data, I first followed the coding techniques of initial coding and focused coding. I also consulted with coding advice from Charmaz (1995, 2000, 2002), Corbin and Strauss (1990), Strauss and Corbin (1998), and Corbin (2008), in particular by Miles and Huberman (1994). I printed out hard copies of all interview transcripts and annotated them manually with code words and notes to look for terms, phrases and concepts being used. All data were also loaded into the ATLAS.ti 6.0 database to assist my analysis work, determine various features and manage data effectively. Mapping the codes by ATLAS.ti offered me some powerful advantages.

The initial line-by-line coding helped me capture meanings in the data at different levels. I used open-ended labeling to identify basic practices and concepts. For example, work roles, job tasks and responsibilities, problems, sources of information, types of information materials, group collaboration, and obstacles, were tagged and described with more specific descriptions within these categories. Following text analysis suggestions made by Patton (1990) and Miles and Huberman (1994), I also identified processes and issues, watched for examples of beginnings and endings, as well as obstacles and resolutions. Through this step, I was able to keep close to the original data, examining it from various points of view, avoiding my own and instructor participants' assumptions, especially any predetermined categories. In the end of this first round of data coding and analysis, I was able to develop a comprehensive code scheme of frequently occurring code words and phrases, which I then consulted as I moved into the focused coding stage. The results I obtained in the preliminary data coding turned out to be too detailed and too long. I thus reorganized and reduced the data coding to identify noticeable themes, recurring concepts, and salient patterns of information behaviors.

For focused coding, I reread the data and reorganized according to the categories. I became more selective, more abstract and conceptual, less open-ended than the line-by-line initial coding process. I did comparative analysis by making use of frequently occurring initial codes to sort through large quantities of data. I synthesized categories to identify and compare variations within categories and between categories. I studied the content of the categories to compare them across the overall dataset. I constantly revised and reorganized the categories. Focused coding offered me a way of finding outstanding threads that could link together different bits of data across cases.

Another technique I used for coding was the constant comparative approach, which assisted data analysis and conceptual framework development for the study. Two kinds of categories were generated from such coding: categories I constructed from the literature (compiling the categories after focused coding), and categories that emerged from the data (Lincoln & Guba, 1985). Strauss (1987) noted that the constant comparative method strengthened the cycle of induction, deduction and verification. In this cycle, concepts that arose from the data are used to test and evolve assumptions drawn from developed theory and provide verification of the interrelation of data and theory. Gorman and Clayton (1997) explained that the constant comparative method was used for theory development and relied heavily on categories of focus and the properties relevant to those categories. As part of the analysis process, I examined, modified and expanded Leckie's model of information-seeking of professionals that can be more directly applicable to dynamic work contexts and situations of fire service field staff instructors as presented in Chapter 9.

In addition, I wrote topic memos, including descriptions and evidence of categories discovered in the analysis (Lofland & Lofland, 1994). As Glaser (1978) defined, "[A memo] is theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding…it can be a sentence, a paragraph or a few pages … it exhausts the analyst's momentary ideation based on data with perhaps a little conceptual elaboration." (p. 83-84). Memo writing from my first time coding to the conclusion of the project offered me a system for documenting comparisons made at category levels, developing categories and properties, and recording the various questions and ideas that emerged during analysis (Charmaz, 2000, 2002; Corbin & Strauss, 1990). My memo writing guided me to collect data in the next interview to fill conceptual holes found in my analysis. It helped me update my interview guide, document my thoughts and emerging ideas, raise additional questions and conduct follow-up phone and email clarifications. It helped me work with my data carefully and make decisions until I reached that “saturation point” where no new data were being produced to alter my understanding and interpretation of the instructor participants’ information-seeking and sharing behaviors.

I continued my data processing and analysis work from February 2009 to December 2009. Throughout its course, I listened to the audio and digital files of the interviews, which helped refresh my memory and interpret meaning for particular parts of the interviews. I redefined codes carefully and systematically. Sometimes I discarded the ill-fitting codes. My iterative coding and review cycles were part of analysis. Eventually, I refined the coding scheme and enhanced coding uniformity. My data processing and analysis work seemed complicated, intense and long; its progression climbed the “ladder of abstraction” (Carney, 1990), data reduction, and transformation (Miles & Huberman, 1994).

4.8 QUALITY AND CREDIBILITY

The variety of data collected in my study helped me gain an understanding of the complexity and texture of dynamic organizations and situations of the instructor participants. It permitted data triangulation, i.e. the opportunity to understand human information behavior using multiple types of data and data from multiple sources, since no one method is capable of addressing different explanations of the empirical world (Patton, 1990). Triangulation techniques were used to ensure the validity of my analysis. Patton (1990) described four different kinds of triangulation, two of which I used: the triangulation of data sources and triangulation through multiple data analysis.

The triangulation of sources compares and cross-examines the consistency of information drawn at different times and by different means within qualitative methods (Patton, 1990). Instructor participants discussed commonly used information sources, personal collections, group work and strategies they used to seek information that was important in the course of instructional activities. I was able to compare and match instructor participants' interview-based descriptions of these issues with what I could find from secondary data and in the literature. When I encountered mismatches and inconsistencies, I asked instructor participants to help me understand and explain. This technique helped me rectify data sources. Follow-up phone calls and emails with some instructor participants provided another opportunity to compare data produced with the same instructor participants.

Another triangulation technique I used was through multiple data analysis. Asking two or more coders to independently examine the same qualitative dataset and then comparing their findings defends against possible interpretive bias (Patton, 1990) and limits a researcher's partiality (Corbin & Strauss, 1990). I invited the Fire Academy's archivist and reference librarian to code one of the same interviewee's full interview transcript in order to check, review and ensure the validity of my coding, as they have experience in the same field and are familiar with my research. Each person analyzed the content of the interview transcripts while I reviewed and coded the same transcripts independently. I compared the respective coding and found strong confirmation between my and their coding. I assessed "intercoder reliability" in the data analysis process in order to protect against interpretive bias and partiality at some level.

I did member checking to increase credibility of the interview findings throughout the analysis. Lincoln and Guba (1985) argued that the most crucial technique for establishing credibility is member checking. Shenton (2004) explained that checking "relating to the accuracy of the data may take place 'on the spot' in the course, and at the end, of the data collection dialogues" (p. 68). As I indicated earlier, I checked the accuracy of the data with instructor participants during and after my interviews ended. I also asked them to read transcripts of dialogue to get their feedback. I followed Shenton's suggestion to put emphasis on whether the instructor participants believed that their words matched what they actually intended, since an audio- and digital recorder was used. Shenton (2004), Brewer and Hunter (1989), and Miles and Huberman (1994) recommended another element of member checking that should involve verification of the investigator's emerging theories and inferences as these were formed during the dialogue. Where appropriate while I conducted interviews, I asked instructor participants if they could offer reasons to explain particular patterns I observed. I followed Lincoln and Guba's (1985) suggestion that the investigator was not bound to honor all of the criticisms about interpretations that are expressed by instructor participants, but he/she was bound to hear them and weigh their meaningfulness.

The central themes and concepts around which the following results chapters are organized illustrate information sources, individual- and group-based activities and strategies that were most commonly discussed and utilized by the instructor participants as a whole or were understood by instructor participants to be particularly prominent aspects of their information-seeking and sharing behaviors. The instructor participants' perceptions, views and experiences, covering a range of issues, are woven together to accurately and uniquely represent their world. To portray a true view of field staff instructors that was localized and particular in time and space, I relied heavily on verbatim narrative from the interview transcripts, using their quotations and stories to demonstrate and explain key concepts, themes, attributes and patterns. More importantly, using excerpts from instructor participants, I presented my own interpretations and conclusions. I also used data from a range of secondary data to support and supplement the themes that emerged from the interviews.

I took a few steps to help protect the instructor participants' anonymity. Across each of the following results chapters, I named all instructor participants with individual pseudonym initials and removed anything that may help readers recognize individuals. The pseudonym initials will assist readers in following my discussion of the participants' experiences.

CHAPTER 5

CHARACTERISTICS OF THE STUDY SAMPLE

As part of the in-depth study of field staff instructors at one site, this chapter provides readers with a contextual frame of reference for the study participants, expanding what was presented about the professional group in Chapter 2. It further explains how they organize and perform their training, teaching and curriculum development, which are the core components of their instructional activities. In the first section below, I review and discuss the results of the demographic part of the Field Staff Instructor Profile. Additional results will also be presented in later chapters. Drawing from the semi-structured interview data, I then identify and illustrate the field staff instructors' work practices in the salient areas of roles, tasks, subject expertise, attributes and problems. I also report how their information needs arose from their professional and personal lives.

5.1 BASIC DEMOGRAPHIC PROFILE

A profile was developed for each instructor participant prior to his or her interview (see Appendix I). The profile data provided a rich source of information, including courses they taught and developed and with whom they worked, as collaboration was common among them. Table 8 below aggregates the basic demographic characteristics of the complete sample. There are several points to feature.

Table 8. Basic Demographic Characteristics of Field Staff Instructors

Composition	**No. of Participants**	**% of N**
Gender		
Men	24	96
Women	1	4
Age		
20-29	1	4
30-39	2	8
40-49	7	28

Table 8. (cont.)

Composition	No. of Participants	% of N
50-59	10	40
60-69	5	20
Highest Education (Degree)		
High School	25	100
Associate	6	24
Bachelor	8	32
MA/MS	7	28
Years in Fire Service		
0 - 9	1	4
10 – 19	3	12
20 – 29	8	32
30 – 39	10	40
40 – 49	3	12
Years in Training & Teaching in Fire Service		
0 - 9	3	12
10 – 19	5	20
20 – 29	9	36
30 – 39	7	28
40 – 49	1	4
Years in Training & Teaching at Fire Academy		
0 - 9	7	28
10 – 19	9	36
20 – 29	8	33
30 – 39	2	8
40 – 49	0	0
Years in Curriculum Development at Fire Academy		
0 - 9	9	36
10 – 19	6	24
20 – 29	6	24
30 – 39	4	16
40 – 49	0	0

The gender distribution is extremely imbalanced with only one female, reflecting the male-dominated world of the fire service. The ratio (1:25) is higher than that for the entire Fire Academy's field staff instructors, as five female field staff instructors are currently on staff

(5:474). Although the sample was not intentionally designed to mirror the ratio of men and women instructors in the Fire Academy, the instructor participants did, indeed, show the trend.

It takes many considerable years of work to accumulate experiential knowledge. The age of instructor participants ranged from 28 to 67 years old. They were on average 51 years old. The study findings mirror the data in the 2007 survey: 90% of field instructor respondents were over 30 years old. The instructor participants in this study had an average of 24 years in fire service, the longest serving 46 and the shortest eight (in the 2007 survey, 51% of respondents had over 21 years as a firefighter). They had an average of 18 years in teaching and training in the fire service to parallel the table, the longest being 40 and the shortest seven. They had an average of 16 years in teaching and training at the Fire Academy, the longest being 35 and the shortest 1. They had an average of 15 years in curriculum development projects at the Fire Academy, the longest being 39 and the shortest 1. The experience (years) breakdown in Table 8 reflects considerable success of the Fire Academy in reaching and retaining top field staff instructors. Younger field staff instructors are under-represented in this sample. There are a number of potential explanations for this finding, such as a lack of experience in curriculum development and limited presence in a high technical level of teaching and training activities.

28% (7 of 25) of the instructor participants have Master's degrees with majors in Public Administration, Business Administration, Executive Fire Service Leadership, and Management and Organizational Behavior. 32% (8 out of 25) of the instructor participants have a Bachelor of Science Degree in Fire Administration, Psychology, Law Enforcement Administration, Fire Science Management, Fire Safety Engineering, Biology, Recreation Management, Fire Command, and Business Management. 24% (6 out of 25) earned Associate degrees majoring in Fire Science, Nursing, Electronics, Applied Science, and Liberal Arts. The results show that all of them have a high school education. None of them have a Ph.D. degree. The instructor participants claimed that they worked in other professions as welder (one), pilot (one), pastor (one), emergency manager (one), nurse (one), engineer (one), architect (one), lecturer (one), policeman (one), and paramedics (three). The diversified education backgrounds of the instructor participants move beyond the fire service profession, but they seem relevant. As I mentioned in Chapter 4, most of the instructor participants worked for paid fire departments in urban cities, reflecting where populations were concentrated and where the strongest fire departments were located. This indicated the large makeup of the geographic distributions of field staff instructors, from which I identified and recruited study participants that would meet the inclusion criteria of the study.

Examining these basic demographic characteristics, the strong work experience of the overall sample is apparent. With years of experience developing their work practices, the instructor participants are all well-established field staff instructors who have solid teaching and training records, and most of them participate in a variety of curriculum development projects as well. As I demonstrate in upcoming chapters, instructor participants were engaged with information-seeking and sharing processes with sufficient background knowledge that they considered themselves experts in the appropriate subject domains. Past literature found job tenure, education and background knowledge to be potential factors affecting the amount of information-seeking (Ashford, 1986; O'Reilly, 1982; Xu, Tan, & Yang, 2006), by which the study findings will stand.

5.2 FIELD STAFF INSTRUCTORS' WORK PRACTICES

As defined by Van House (2004), "[P]ractice is people's actual, daily, embodied activity, often including skills, tacit knowledge, and presuppositions, as well as their interaction with others and with material and other resources” (pp. 41-42). During the interviews, the instructor participants passionately described their work practices and explained to me their typical instructional activities with clearly defined objectives and well-planned out schedules and calendars (see Appendix C). The lengths of different classes or programs vary, ranging from one day to six weeks. A class may occur either during the day or at night, or occasionally both. The class often starts with the lecture portion in the classroom. Instructors convey cognitive knowledge learning by using PowerPoint slides. It is then followed by “hands-on” or “the practice.” In the end of the class, instructors tie everything together and ask students to run through incidents from start to finish [CD_3_5_2009].

The vast majority of field staff instructors’ time is spent in the preparation of the course, direct instruction and developing the curriculum. In my study, I regard the instructor participants’ work practices as the process, in the ways they take up roles and carry out tasks in teaching, training and curriculum development. Such work practices are set by formal agreement between the field staff instructors and the Fire Academy in particular, and fire service in general, as well as by traditions and values that have developed and been followed without any formal agreement. Field staff instructors’ instructional work is more task oriented, and often tasks are placed under time constraints while pursuing multiple objectives (e.g., technical and training considerations) by following the Fire Academy’s training mission and instructional goals. Their emphasis is generally on solving practical problems, like the engineers I described in Chapter 3. The output of their task tends to be a product (a class) or a process (training, teaching, and curriculum development) that is associated with different information activities and sources of information.

5.2.1 Roles. Tasks

Miles and Huberman (1994) defined a role as “a complex of expectations and behaviors that make up what you do, and should do, as a certain type of actor in a setting – a family, a classroom, a committee” (p. 122). A task can be either routine or non-routine with unanalyzable problems and high exceptions (Perrow, 1967), or uniform or not uniform (Litwak, 1961). As I discussed in Chapter 1, Leckie, Pettigrew, and Sylvain (1996) suggested that “work roles” and “tasks” were the prime motivators for a professional’s information-seeking. They summarized five professional roles that were frequently mentioned in the existing empirical studies as service provider, administrator/manager, researcher, educator, and student (p. 181). In my 2007 survey, field staff instructor respondents (N=104) reported that they spent different percentages of time on these five roles. The interview data furnished evidence of the existence of the five roles along with additional roles they assumed, and complicated tasks they performed, while working in a dynamic organizational context as shown in Table 9 below.

Table 9. Field Staff Instructors’ Multiple Roles and Complicated Tasks

Multiple Roles	Associated Tasks	Sample Quotation
Teacher	Canned course	Most of the classes I do, the objectives are already prepared and also the final exam questions [HG_3_2_2009].
	New course	It’s about aircraft rescue for volunteer and suburban departments. There was no curriculum. There was no class. So we had to start from scratch [JD_2_5_2009].
	Revise course	Truck Company Operations is a class we do in fall, and I put that together, probably back in [19]93, and then I’ve continuously updated and revised it [RH_1_30_2009].

Table 9 (cont.)

Multiple Roles	Associated Tasks	Sample Quotation
Trainer	Develop hands-on and physical skill exercises and demonstrate practices	The skills in many cases is just a matter of taking the individuals out, and going through the process step by step, inch by inch, whether it's placing in their hands or foot there, how to move your body, how to lift, how to turn, involved in putting a ladder up, or whether it's working with a tool, whether it's crawling and searching. A lot of that you have to demonstrate [RH_1_30_2009].
Writer (Curriculum development, see Appendix L, M & N)	New course from scratch	It was started from scratch but it was based on experiences from other instructors [LL_2_18_2009].
	Tweak an existing course, not to reinvent the wheel	Someone might have already done the topic, and all you have to do is to pull it out and tweak it and make it work for you [RL_2_11_2009].
	Update a course	We've updated that course five times since 2002 at least annually because the incident management world changes so we have to change the curriculum [BF_3_11_2009].
	Rewrite a course	I would say none of our curriculum [hazmat] is static. It's all dynamic to a degree, and just about the time we finished updating it, it is time to do it again. So the breathing room for these has gotten very small [RP_2_19_2009].
Manager/Coordinator	Pick and hire instructors	There are probably about fifty people [instructors] we rely on regularly for firefighting training… it is a lot like dating. We are trying to find out the right match for the right person [TS_3_4_2009].
	Manage courses and instructors	I'm generally orchestrating or organizing and managing those types of class, whether I actually physically teach the class or not [JL_2_23_2009].
Student/ Lifelong Learner	Self –taught	I like to teach myself [JS_3_17_2009].
	Learn from other instructors	When you are there teaching, you are not just teaching, you are learning [MC_2_12_2009].
	Learn from students	I taught the class based on student feedback and questions they are asking [LL_ 2_18_2009].
Reader	Keep up-to-date	I'm a reader. If you are a new instructor, read everything you get your hands on [BF_3_11_2009].

Table 9 (cont.)

Multiple Roles	Associated Tasks	Sample Quotation
Researcher	Teaching	I do research on it [teaching] all the time. We've been doing the class for five years. I'm still always looking for new stuff [LL_2_18_2009].
	Research project	I spend an incredible amount of time in the research Dr. DS does [CAH_2_17_2009].
Mentor	Develop new instructors	Mentorship [means] you are sharing knowledge, but to me, you are sharing the affect in your domain, sharing attitude as much as you're sharing knowledge [BF_3_11_2009].
	Serve as expert source of information	My mentors took me under their wings as a young instructor, and said, "Hi, I'm going to teach you everything I know about this class. That's how we did it" [LL_2_18_2009].
Role Model	Set up good examples for others to follow	I took Instructor I and from that point on, it was a matter of shadowing other instructors, learning from them, watching them, watching how they connect with students, learning the difference between good and bad ways of presenting information that were more successful on the field [JL_2_23_2009].
Facilitator	Facilitate learning, information and knowledge sharing	I would prefer to think of it as the fire instructor is a facilitator of information and knowledge, so they facilitate learning. The job is so complex and so varied and so dynamic that not any one person is capable of becoming an expert on it [TS_3_4_2009].
Group Member	Team teaching	There are numerous instructors involved in it. It's team work on it. Different tasks, different topics, confidence builders, preparation, present and future officers. Yes, lots of team teaching, lots of street experience in it [EE_2_25_2009].
	Team writing	I've worked on a curriculum project…it's a brand-new class…The best way to work here is we work in teams. Most always there are at least three or four guys…It is very valuable to work with a group of four because no one can have all the information [RP_2_19_2009].

Leckie and Pettigrew (1997) stated that the primary activity shared by all professionals was the provision of various types of service or expertise to their clients. I found that the roles of teacher, trainer, writer, researcher and mentor were different aspects of the service provider role for the instructor participants. For example, they often provided information and services directly to the students and expertise to other instructors when they were engaged with the substantive areas of instruction in meeting training needs and objectives. The researcher role for most of the instructor participants was, in fact, more of an integral part of their role as service provider. It was not a strong separate role in the way it was for engineers and members of the health professions, although instructor participants recognized the importance of doing research whether they developed a new curriculum, taught a course or trained a new skill to "make a point" to students and prepare them to respond to an emergency incident in a safe way. In the information producer category (Martin, 1998), engineers were classed as "information producers" of a "science and technical" type. The curriculum that the instructor participants produced demonstrated that they were also essentially the information producers of technical fire service knowledge. Impressively, the instructor participants were hungry and humble lifelong learners even in the primary subject area. One instructor participant indicated that during classes if he was not teaching a section, he pretended that he was a student and tried to pull something out and tried to learn something from the current instructor that was up there [LD_2_17_2009]. Several instructor participants emphasized that they were "the student[s] of the fire service." They advised new instructors to maintain steady reading and learn "everything possible" they needed to learn about this job and to "be like a sponge to absorb all the information" [LL_2_18_2009]. It also is noted that not every instructor participant took all roles, depending on the subject areas and individual level of expertise, experience and responsibilities. Some instructor participants performed more roles than others.

5.2.2 Subject Expertise

Of the 25 instructor participants, 14 of them claimed that their primary expertise is in Firefighting, 3 Rescue, 2 Hazardous Materials (Hazmat), 2 Unified Command, 1 Fire Investigation, 1 Liquefied Petroleum (LP), 1 Industrial, and 1 Emergency Medical Service (EMS). It is not surprising to see that most instructor participants were from the Firefighting Program, as it was the largest Fire Academy training program. The study findings also reveal the instructor participants' multiple specialization orientations. For example, the same instructor participant who taught Hazmat taught Essentials (of Firefighting). He was involved with curriculum development of Engine Company Operations, Instructor I & II, and all Hazmat courses. The instructor participants tended to seek opportunities to "branch out" their knowledge base and to be exposed to as many different topics as they could. Several of them proudly stated that there were only a few programs in this entire Fire Academy they had not taught yet. For more information on specific courses taught and written by the instructor participants, see Appendix N, which was generated by data from their interviews and profiles. On the other hand, instructor participants were open to new ideas, humble, and admitted that their "expertise is very limited," [TS_3_4_2009] and they "can't be an expert on everything" [JD_2_5_2009]. As RAV realized, "there are so many things to understand…it could probably take a lifetime to understand all these aspects of that" [RAV_3_10_2009]. Knowledge development in the fire service is time-consuming, and it is not easy. The instructor participants were clearly aware of accumulating operational experience while the scope of training keeps expanding. The more subject areas an instructor spans, the greater the work it requires and the longer the time it takes, the more challenges he may face in terms of information-seeking.

5.2.3 Attributes of the Field Staff Instructors

The Fire Academy attracts and hires the best quality instructors for field staff instructor positions. The instructor participants often stated that they handpicked and recruited the qualified instructors to the team, and they looked for particular attributes that balance education, experience and personalities. LL explained:

> I want the best guy. When I bring the guy to any of my programs, he needs to be well-educated and street smart. You got to do on the street. That is done through experience. Your experience is making you credible in the classroom or in the drill yard like we are doing here… I want educated instructors. I want compassionate, meaning they are empathetic with students. But at the same time, I want a little bit of edge to them. In the fire service, you need to have a little bit of a chip on your shoulder. I look at it as confidence. I want guys that they can communicate. They can get along with other people. I want guys to believe in their heart of what the core value of our programs is. Our program is about developing good fireground battle ready officers [LL_2_18_2009].

Other instructor participants outlined multiple skills and attributes an instructor must possess in order to be successful in the fire service training business, as WBM put it:

> You have to be a people person to be in this business. You have to be very open minded and understanding. You need to be able to [do] research, understand where you are going to teach. So there, you have to be experienced; you have to have credible background. You have to [have] knowledge base, willing to acquire more information, more knowledge, and share resources. You have to be open, sharing information back and forth. You have to be comfortable. You have to be confident without being

> overconfident. You have to be flexible in your ideas and thinking to communicate with people, different people [WBM_2_10_2009].

Professional credibility seems of most importance to field staff instructors. It allows instructors to proceed with work and to be accepted and recognized within the Fire Academy and fire service community.

The instructional process is truly a "balancing act" for the instructor participants. They are required to master technical knowledge, accumulate personal experience, and keep abreast of new knowledge so they can feel "comfortable" in front of students and instructors. They also must build, develop and maintain active networks of different people in the profession and share information with them. They must establish an area of core expertise while they explore new subjects and get involved in new areas of training need and growth.

5.3 INFORMATION NEEDS OF THE FIELD STAFF INSTRUCTORS

Based on the analysis of the interview data, the instructor participants' problems and information needs are identified and discussed to help further understand their instructional work. As Xu, Tan, and Yang (2006) claimed that information need was highly context dependent, the instructor participants talked about their problems and information needs that were contextualized in the operations. CAH noted the need to "see," "hear" and "interact," with problems in the field, and his experience helped him identify those needs and create training programs to solve the problems:

> Lots of times needs come from experience being in the fires, or you hear about concerns, issues from firefighters whether it would be an email, a phone conversation, and a personal conversation. I mean you hear about the problem that occurs as you interact. Then also you see them as you go to incidents. Typically for me, based on hearing about

> it, seeing those problems, my mind always heads toward I should be able to fix that by improving how we train. Very rarely needs come from books and articles. In fact, I don't know that classes I write ever come from books or articles. The classes I put together come from experiences that I see an issue, see a concern, an area falling down then I try to figure out a system to deal with that [CAH_2_17_2009].

The instructor participants also obtained feedback from team instructors, firefighter students, and people in different organizations. A range of sample issues associated with work-related situations described by the field staff instructors listed as follows: Firefighters need a certification program to obtain Firefighter III certification. Firefighters ask to gain specific skills and knowledge, such as reading fire smoke, or to master new equipment, such as the thermal imaging camera. Field staff instructors were asked to create training programs to meet needs of volunteer and smaller fire departments. Local fire departments and organizations asked to help them understand requirements from OSHA (Occupational Safety and Health Administration), DOT (Department of Transportation), and DOL (State's Department of Labor) standards. Common problems and needs could also be identified from state and national incidents, such as events in Utica and Hurricane Katrina. To fulfill these needs, the instructor participants developed new training programs and wrote and/or revised curriculum.

In addition, personal issues, interests or hobbies could create problems and drive the instructor participants' information needs. Drawing on his emotional pain and frustration from the loss of his beloved fire chief father, one senior instructor participant worked with ten other instructors. They created a new Saving Our Own training program that focused on tools, tactics and techniques to prevent future firefighter fatalities. Other instructors found relevant segments for teaching and training from their personal interests in TV channels, such as the History

Channel, the Learning Channel and the Discovery Channel. Finally, JL, an amateur builder who was fascinated with architecture, in particular century-old cookie-cutter houses in town, created a startling training course on firefighting in cookie-cutter houses.

The instructor participants' information problems and needs are complex, multi-dimensional, and dynamic. Their needs not only arose from work-related situations, but also from personal interests, which have not been accommodated in the Leckie model, and rarely studied in information behavior research. Leckie, Pettigrew, and Sylvain (1996) only considered specific work roles and tasks of professionals that were determinants of the information needs. In the fire service, subject and problem areas evolve, new needs emerge and the organizations of instructional work keep changing. The focus and the structure of inquiry are further influenced by the actions of individual field staff instructors. Their everyday work practices and personal interests alter the shape and development of fire service training and affect the ways they seek and share information.

5.4 CONCLUSION

In this chapter, I presented a framework for considering what constitutes the work of instructor participants and identified some problems and information needs central to facilitating that work. Through the field staff instructor's lens, this chapter helps readers contextualize the situation of the overall sample and understand instructor participants' complex work practices and dynamic information needs. Examining essential components of instructor participants' work practices draws our attention to important points, particularly how practices communicate critical information to ensure effective information-seeking and sharing on a daily basis and meet information needs in a timely fashion. Those practices embedded in daily work also serve as vital sources of information, as will be discussed further in chapters 6, 7 and 8.

Like the activity of engineers reviewed in Chapter 3, field staff instructors make extensive use of communications in the conduct of their daily work through interpersonal and group means, as well as through information found in documents. In the next three chapters, I concentrate on the instructor participants' information activities, in particular, the kinds of information sources they sought and shared to obtain needed information critical to instruction. The aim was to identify these information sources and explore how they solved the instructor participants' information problems and assisted in decision-making in the instructional process. I considered the similarities and differences apparent in the types of information individuals used and the form in which it was provided, as well as strategies that helped them seek and share information.

One important distinction that is made in the literature on information-seeking is between formal and informal sources of information (Case, 2007). Xu, Tan, & Yang (2006) grouped two types as personal or impersonal sources of information. Shih & Evans (1991) classified three types: oral, written and electronic sources of information. Some categorized them as internal and external sources of information (Bin, 2009; Byström & Järvelin, 1995; Choo, 1994; Gralewska-Vickery, 1976). For analysis purposes, I categorize information into three types: formal/institutional sources of information will be discussed in Chapter 6, informal/personal sources of information in Chapter 7 and group network-mediated sources of information in Chapter 8.

CHAPTER 6

FORMAL AND INSTITUTIONAL SOURCES OF INFORMATION

In the fire service, codified knowledge contains formal and institutional sources of information that directly support fire service knowledge structures of KSA, especially cognitive domain learning (see Table 1). As I discussed earlier, sources or channels of information utilized by professionals can be classified as formal or informal. Garvey & Griffith (1968) defined formal channels as those bearing information that is public, impersonal and kept in permanent storage (Russell, 2001). My study focuses on both source and channel (e.g., Daft & Lengel, 1986). From the instructor participant's point of view, a source may have relevant information, whereas a channel may lead him/her to pertinent sources. A source may turn into a channel, and vice versa. Therefore, my study makes no clear-cut distinction between channels and sources. Lloyd (2007) suggested that formal and institutional sources of information are well-indexed, organized and categorized. In this chapter, I report and discuss what kinds of formal sources of information the instructor participants used and how they consulted them to perform their instructional work. A variety of these sources are sought and used by the instructor participants in print and media formats, both from the library and from digital sources (chiefly on the Internet).

6.1 PRINT SOURCES

Lloyd's (2007) formal textual site for Australian firefighters' modalities of knowledge domain (see Table 2) encompasses codified knowledge consisting of technical and training manuals, administrative documents, policies, procedures and formal statements relating to work and work practices in the form of facts, propositions or concepts. Information is sought within this site through either print or digital sources (Lloyd, 2007). Gralewska-Vickery (1976) categorized written sources as “literature” (books, journals and conference proceedings), reports, records, memoirs, abstracts, bibliographies, maps and drawings. Case (2007) included textbooks in his formal source in print.

Drawing upon the semi-structured interview data, I found that the instructor participants were concerned with various sources of information in print. A complete list is included in Appendix O. The sources comprise all print sources mentioned by the instructor participants in their interviews and further explain the types of print sources they needed, which contain some of those outlined in Lloyd’s list above, Gralewska-Vickery’s literature of journals and books, reports and Case’s textbook. My use of the categorical variables “external/internal” allows a comparison of the types of sources in print used by all the interviewees. Most of them are external and formal documents with technically validated, codified and publicly available information, such as standards and regulations. Some are proprietary information, such as the Fire Academy curriculum. Like engineers (Anthony, 1986), technical information is very important in fire service training and its related activities and operations.

The instructor participants indicated that the most used and highly important of these items were reference sources of NFPA standards, curriculum and literature, especially trade journals and textbooks, as shown in Table 10. The Fire Academy’s library collection is well matched in this aspect to fully support field staff instructors’ needs.

Table 10. Most Used Formal Sources of Information in Print Format

Type of Print Source	**Internal/External Document**	**Sample Fire Academy Program/Course**
Standard		
National Fire Protection Association (NFPA)	External	Aircraft Rescue, Confined Space Rescue Technician, Firefighting, Fire Investigation, Hazmat, Industrial Programs, LP, Trench Rescue, Technical Rescue

Table 10 (cont.)

Type of Print Source	Internal/External Document	Sample Fire Academy Program/Course
Curricula		
Fire Academy Curricula	Internal	Firefighting, Hazmat, Trench Rescue, Industry
Curricula from other organizations	External	Firefighting, Hazmat, Safety Officer, Unified Command, Women in the Fire Service about Mass Casualty Triage
Literature		
Textbook	External	Fire Officer, Technical Rescue, Fire Academy, Fire Investigation, Firefighting
Trade Journal (Articles)	External	Emergency Medical Service, Firefighting, Fire Investigation, Hazmat, Unified Command System, Trench Rescue

NFPA Standards. The instructor participants usually consulted reference sources, especially National Fire Protection Association (NFPA) standards and Office of State Fire Marshal (OSFM) objectives, which satisfy NFPA standards, at the beginning of curriculum development as a "starting point," "basic framework," and "a tool to cross check." It is a common task performance behavior. The course objectives are basically "derived" from NFPA standards (and other standards depending on subject area) so field staff instructors have to meet certain standard requirements. They write and create course curriculum based on NFPA standards and those OSFM objectives. The standards and objectives helped instructor participants "filter" what they needed to include and emphasize in the curriculum, set measurable objectives, and determine how much time they should allocate. The instructor participants were trying to use NFPA standards more to make their courses "more nationally recognized and to be interchangeable in essence between states and regions." As EB put it:

> I am beginning more and more now to use objectives that are written from *JPRs* (job performance requirements) from the NFPA Professional Qualification Standards. So we

> are trying to focus on national JPRs and objectives written from those JPRs. In the NFPA then the professional qualification series, for a firefighter, fire officer, fire investigator, public educator, all of those have job performance requirements out there. And they are not really an objective. They look similar to an objective, but they are skills that the individual needs to know to actually perform the job. So in order to teach those skills, we have to write objectives then teach those skills [EB_3_10_2009].

In describing their experiences with print references, NFPA standards stood out as the most important source, especially at the beginning of curriculum development. The instructor participants' desire for and effort toward curriculum standardization was apparent even though they faced challenges of constant changes of standards at the national level and inconsistent objectives from different organizations. The Fire Academy Library has NFPA standards in three formats - print, online (with single user access due to high subscription fees) and CD-ROM. The online standards help the librarian access the most current edition of standards in a timely fashion. Field staff instructor users often ask the librarian to send them a print copy of the most recent standard, so I classified the NFPA standards as print.

Curriculum. While the field staff instructors are engaged in information-seeking during their curriculum development, they are also engaged in knowledge production of writing curriculum. The instructor participants reported they "mirrored" existing external and internal curriculum closely when they developed new courses, as one instructor participant explained:

> Understanding what curriculum is most currently available is probably 50% of developing curriculum. There is no sense of reinventing a wheel. If you can find a program someone else has, then using it has a certain level of success. You can use it as a basis. As a State Fire Academy, we are always turning to the National Fire Academy for

> their curriculum. We are also looking to other state academies that we feel [are] exceptional [BF_3_11_2009].

Everything in the fire service that instructors are doing is essentially not new. Something is taken from somewhere else, tweaked, honed, edited and made more relevant to today's hazards and problems. Typically, "remodeling" the existing programs meant to "take and pull" out of different courses at the Fire Academy, or to get ideas from somebody who was already doing it from other external organizations. The instructor participants then "tweaked" them, and finally "put it together" to make a new program, as LD illustrated how he developed his new program:

> The main way I prepare [the Command and General Staff class] is I take the student manual that we got from the National Fire Academy and the PowerPoint slides that we have gotten from them and modify to fit our way we teach or enhance them. We have modified them but we added some extra to make it a better teaching process for our students [LD_2_17_2009].

The instructor participant's strategy was to locate where the topics had already been organized in classes, and to interpret and apply them in a way that could be useful for their curriculum development purpose. It was important for them to understand how the connections were made and which parts of existing knowledge could be utilized and incorporated into new programs.

Among other items, the Fire Academy Library's key archives contain documents produced by field staff instructors, including curriculum dating back to the earliest year of 1955, entitled "*Officer Training Manual in Firemanship*" (The Fire Academy Archivist, personal communication, March 1, 2010). However, field staff instructors have restricted access to the curriculum collection and must obtain approval from the Deputy Director since curriculum materials have been treated as proprietary and highly technical documents. Filed curriculum materials are organized and retrievable by the Fire Academy Programs (e.g., in chronological order, Firefighting Program, Hazardous Materials Program, Homeland Security Program, Investigation Program, Officer Program, Prevention Program and Rescue Program). These curricula are regarded as internal to the practices since they have been developed by field staff instructors and form the essence of their work practices.

Literature, i.e., trade journals and textbooks, is an important component of field staff instructors' information activities. Reading these kinds of materials continued to be an important information practice for the instructor participants. None of them complained that there was too much to keep up with in their reading, and they read regularly. Senior instructor participants read as much as the younger instructor participants, regardless of experience level. Through reading, they all kept abreast of developments in their respective fields, for both work responsibilities and personal interest. Instructor participants believed that reading kept them up to date and well prepared, as CD explained:

> As instructors, if we read something [new] in current events, current trade magazines, or new books that are out, we are always encouraged to add the new things in [to the class we are teaching].We try to keep things updated [as] current as possible. I see good textbooks coming available. Books deal with something I am interested in. I pick them up. I go through magazines, I get certain subscriptions, and I read through them [CD_3_5_2009].

For keeping up-to-date, trade journals were reported as a critical source. To glean new information, instructor participants scanned different articles on the subject they had been teaching. The trade journal articles served as effective tools for the instructor participants' teaching, so they could share knowledge in the class and give students "a place to go for information." *Fire Engineering* was one of the key trade journals instructor participants mentioned the most because it covered firefighting research and practices on a wide range of topics. RL strongly encouraged new instructors to look into trade journals. His first preference was *Fire Engineering*. This same title was also a principal source for several instructor participants, who had a different subject orientation. Other instructor participants from different subject areas mentioned key titles, like *Rescue, JEMS (Journal of Emergency Medical Service),* and *Firehouse.* The Fire Academy Library subscribes to all major fire trade journals in print, including *Fire Engineering*, due to the high demands of users.

The instructor participants used textbooks since they were published by the major fire publishers and written by well-known experts, such as John Norman's *Fire Officer's Handbook of Tactics*, to which several instructor participants referred with "great admiration." Norman is a highly respected expert in the field. TS noted that books offer "factual information." JD regarded textbooks as "confirmed sources," "accepted source[s]," and "established text that everybody knows." Describing himself "still a little old fashioned," RAV continued to value textbooks even with the advent of the Internet because "textbooks offer a lot of very specific information. A lot [of practices in the fire service] has not changed…A textbook is still a good resource" [RAV_3_10_2009]. The instructor participants believed that they could use textbooks to "get the best information, and it is also referenceable" as BF illustrated:

> For example, when I was teaching logistics, *Moving Mountains* by Lieutenant General Gus Pagonis is an excellent text on logistics [in regard to emergency management]. To me, written work is more durable. It took more time for the writer to think that through

and write it than it is to a producer to stick a 2-second clip in video. Video is wonderful but it is not the resource that written work is [BF_3_11_2009].

Other kinds of print information also come into play, such as the most notable guidebooks in certain subject areas like *Emergency Response Guide* (ERG) for Hazmat programs. Every four years, field staff instructors have to tweak at least the awareness level of Hazmat Training because it is based largely on that book. Every time the book changes, the curriculum has to be changed [RP_2_19_2009].

As these examples demonstrate, the ongoing and particular use of information in print format is involved heavily in the instructor participants' instructional processes. Despite the availability of information on the Internet and in digital format, and an experiential knowledge focus, these print sources continue to be the most valuable sources of information. This finding is consistent with the 2007 survey, as field staff instructor respondents ranked print (books, codes and standards, regulations and manuals) as one of the top information sources. Similarly, engineers used print sources (see literature review in Chapter 3). The reliance on formal sources in day-to-day practice is also demonstrated in other studies (Wicks, 1996; Wilkinson, 2001).

The fire service is a relatively high maintenance and dynamic field for field staff instructors. Even though they have built up their knowledge and expertise over time, updating knowledge and experience becomes a required practice. What literature instructor participants use tends to be from their own trade, such as trade journals, textbooks and curricula – rather than research publications. This is fully in keeping with the fire training context in which field staff instructors work with specific objectives that are not intended to contribute to the scholarly fire research, but rather to practically train firefighters to be prepared.

6.2 MEDIA SOURCES

The instructor participants actively used media sources (e.g., PowerPoint slides, videotapes, DVDs, CD-ROMs, movies and TV programs) in their instructional practice as shown in Table 11.

Table 11. Formal Sources of Information in Media Format

Media Source	**Internal/External Document**	**Sample Fire Academy Program/Class**
PowerPoint Slides	External/Internal	. Command and General Staff . Cornerstone . EMT . Fire Officer Command School . Respiratory Protection Program . Tactics and Strategy . Technical Rescue
Videotape. DVD	External/Internal	. Fire Essentials . Firefighting . Fire Investigation . Fire Officer Command School . Hazmat . Tactics and Strategy
CD-ROM	External/Internal	. Emergency Medical Technicians . Confined Space Rescue . Firefighting
Movie	External	. Firefighting
TV Channels. TV Shows	External	. Firefighting . Homeland Security

I only treat institutionalized PowerPoint slides and commercially produced and institutionalized videotapes, DVDs and CD-ROMs as formal sources of information here. Lloyd did not explicitly include media sources in her three modalities of the knowledge domain of Australian firefighters. I did not find studies that focused on engineers' use of media sources.

PowerPoint Slides. Developing and using PowerPoint slides in the instructional process is common. The Fire Academy provides PowerPoint slides along with other supporting documents directly to field staff instructors for its canned programs. The instructors have “leeway” to add additional slides based on their expertise and experience. For new programs, the instructors have to either create PowerPoint slides from scratch or modify them from the existing programs in consultation with program directors to fit the Fire Academy’s teaching methods. Three senior instructor participants mentioned they used “transparencies, which are now PowerPoint slides” in their earlier curriculum development, teaching and training. Transparencies for an overhead projector were one of the most popular teaching aids in the 1990s, and the Fire Academy Library used to have a popular transparency collection. The library has gradually yielded to new technological tools, however, such as PowerPoint. The library collects and catalogs the Fire Academy’s PowerPoint slides in its collection.

Videotape. DVD. According to the Fire Academy Library’s circulation statistics in the past decade, institutionally-made, primarily commercially-made videotapes have been one of the most popular items for field staff instructors to use in their teaching and training, as the format itself has evolved from Beta to 3/4 video, then to VHS and now to DVD. The instructor participants described how they effectively used videotapes to improve students’ understanding and class productivity, as they used a 20- to 30-minute videotape to enhance their lecture-classroom instruction. The students have “seen it visually” so they are now “on the same page” [RL_2_11_2009]. Other instructor participants saw the benefit of using a videotape to enhance students’ understanding because videotapes could “stimulate the students when they see the actual fire scene” [RH_1_30_2009]. One instructor participant illustrated how he used videotape about current incidents as resources to evaluate the emergency response practices, raising questions about tactics in order to “tweak and fix the learning experience.” He asked himself, “Do we need to change something in curriculum up here at the Fire Academy to solve that same issue again?” [MC_2_12_2009]. For the Online Program, videotapes and DVDs are powerful tools that the instructor must utilize, as RAV explained:

> DVD is a different teaching tool that we use on an online world. For example, the DVD package was on aerial operations. It was all very technical information and we couldn’t do with just a couple of pictures. It had to be full-length videos so that was where the concept of the last DVD came…We wrote a regular, like a motion picture script for the whole 45 minutes segment…We put together a 270-page study guide for the instructors and the students to understand the file along with every one of these videos. So we end up with ten full-length videos and there is a section in the study guide that covers each one of those particular areas [RAV_3_10_2009].

CD-ROM. CD-ROM has served a special role for the Fire Academy’s instructional programs. The structured training programs are hardly available in the local fire departments. Since 2003, the Fire Academy designated one instructor in charge of developing a series of CD-ROM training packages that supplement local training needs. The series was made available to every fire department in the state at no charge. It includes *Firefighting Skills,* which just teaches basic skills such as putting on and removing packs; *Firefighter II,* which has 35 different short videos demonstrating the basic skills of throwing ladders, doing hydraulic hook up, putting air packs on, and putting water on fire, along with a teaching outline. Fire department training instructors can use the teaching outlines to prepare themselves, give a lecture, show a video on a specific task and then actually go out to train in the field. The students can perform all that firefighters can perform in practice [RAV_3_10_2009]. The CD-ROM program has been well-received in the state, and out-of-state requests for the program have been made.

Movie. TV Program. Five instructor participants mentioned that they used movies or movie clips in teaching and training. Three used segments of TV shows or TV channels. Watching TV programs often occurred in the evening when the instructors were at home. One instructor explained information acquired from TV programs stimulated his new thoughts on teaching:

> I'm an avid viewer of the History Channel, the Learning Channel and the Discovery Channel. And I will find that a single statement made in some movie about disasters or movie about explosions or something will rattle in my head. I will use those for my teaching. I never use those as the reference source since they trigger thoughts. Videos are made to excite people [BF_3_11_2009].

As part of their instructional process, instructor participants actively took advantage of media sources through new technological tools and leisure time entertainment to enhance their instruction and facilitate student learning. In my 2007 survey, 47% of field staff instructor respondents (N=99) ranked AV (media) materials as one of the top five formal information sources. Non-print (media) materials are reported as one of the most widely used teaching aids for fire service instructors (Ruan, 2001) and this continues to be the case, as demonstrated in Table 11. The Fire Academy Library has developed the largest media collection in the state. The instructor participants depend highly on the library's media collection. Personal copies of media materials, in particular videotapes or DVDs, are extremely difficult to purchase and maintain because of price and security concerns (Ruan, 2001). For example, a six-videotape series, *Fire Investigation*, produced by National Fire Protection Association, costs non-members $1,452 and members $1,307. A single videotape, *Introduction to Hazardous Chemicals*, produced by Emergency Film Groups, costs non-members $303 and members $272.25. Over the course of its collection development, the Fire Academy Library has purchased and updated all relevant titles of media available, most of them requested by the field staff instructors.

6.3 LIBRARY

I placed the library in this chapter because it holds institution-based knowledge and makes its multi-media collection publicly available. The 2007 survey found that 97% of field staff instructor respondents (N=115) were highly aware that they could make use of the Fire Academy Library, and 84% of them had a favorable attitude toward the library in general. According to the survey, 96% of participants believed that their different work roles led to different information needs. The following sampling of reference requests made by field staff instructors with subjects highlighted provides a good indication of the kinds of information they are looking for from the library, what materials are available on firefighters' KSA (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) domain learning in the library and what types of activities they were engaged in (see Table 12).

Obtaining and utilizing information on topics, as shown in Table 12, is critical to helping field staff instructors deliver the best training and curriculum products that they can. The data presented in Table 12 indicate that the Fire Academy Library has materials on the knowledge and skills domains to answer inquiries. But it has little information to support the affective domain of learning. The library cannot provide comprehensive services of materials to meet instructors' needs in all three domains of learning.

Table 12. Sample Reference Requests Made by the Field Staff Instructors

Request	Library Materials on Knowledge (Cognitive Domain)	Library Materials on Skills (Psychomotor Domain)	Library Materials on Affective Domain	Curriculum Available in the Library	Type of Activity	Topics in Online Fire Thesaurus
1) "I am looking for materials regarding ***foam*** for a class I am developing."	√	√		√	Curriculum Development	Foams
2) "I am developing a class. What books do you have on ***air monitoring***?"	√	√			Curriculum Development	Air monitoring
3) "Do you have any ***Standard Operating Procedures*** that we could use?"	√	√			Teaching. Training	Standard operating procedures
4) "Can I have a copy of ***NFPA Code 10***?"	√	√				Fire codes
5) "Please send me copies of articles pertaining to ***heat stress*** research."	√	√	√			Heat stress
6) "Do you have any DVDs on ***structural collapse***?"	√	√				Structural collapses

Table 12. (cont.)

Request	Library Materials on Knowledge (Cognitive Domain)	Library Materials on Skills (Psychomotor Domain)	Library Materials on Affective Domain	Curriculum Available in the Library	Type of Activity	Topics in Online Fire Thesaurus
7) "Do you have materials regarding ***vehicle extrication***?"	√	√		√		Vehicle extrication
8) "I was looking for the ***Rapid Fire Test prep software*** that referenced these books. I have the actual books, just wanted the study software to go with them."	√	√				Fire tests
9) "I am looking for information regarding ***organizational structures*** of small combination departments (less than 10 career members)."	√	√				Fire department manage-ment; Work schedules; Job descriptions; Employees; Employ-ment

The instructor participants in this study demonstrated similar high levels of awareness, attitude and reliance on the Fire Academy Library and other libraries. They appraised that the library was "fabulous" and had a "whole wealth of the stuff." The librarian had been "great;" the amount of stuff that she gave to instructors was "unbelievable," and she could "zero in on specifics much better" than they could. One instructor participant described the reasons he used the library and how the librarian helped him save time and found what he needed:

> I would have never thought of myself going to a library and using this library in the beginning. I use the library more now for two reasons. Number 1, those people [librarians] know what to look for faster so it saves me time and I stop having to do it myself. Now it's nice to get help because they have the expertise to find information quicker. The other thing is the library has good resources still as it is trying to keep current stuff and actually it has lot more information. The library is good at research [RAV_3_10_2009].

Contrary to engineers' unfavorable attitudes and low rank of usage of libraries (see review in Chapter 3) and no mention of libraries in any of Lloyd's three sites, the instructor participants were obviously satisfied by the library services and put their trust in the librarian. They started here with the library and shot from there [RP_2_19_2009]. If they did not have the answer, they went to the library. The librarian was "the somebody" to ask to verify the information. The instructor participants made requests to the Fire Academy Library and relied heavily on the librarian if they needed a printed document, especially standards published by NFPA (National Fire Protection Association), OSHA (Occupational Safety and Health Administration) or ASTM (American Society for Testing and Materials). For more than a decade, the Fire Academy's library has been successful in building "tremendous resources" to meet field staff instructors' needs. One senior instructor participant encouraged young and new instructors to learn from the librarian to advance their careers and overcome intimidation about libraries. He shared his life-changing story:

> A girl, Susan, lived down the street that I grew up. She was a librarian at a local college. One day, I got into the car and drove down. I told her that I needed her help. I needed to know where to go, how to find information. I was kind of lost. Susan said, “We’ll find whatever you need and I’ll help you.” Some days, I would go down and she would walk me through. “This is how you do this. I’ll show you how you find it.” Other days, she would tell me that it will take her couple of days. She’ll call me back. She gave me information that I needed…I learned to do research, learned to find information, how to talk to people, and reference it, and go from this and how this answer would lead me to these three questions...Really Susan taught me how to do that. If I had made a recommendation to a new instructor, and I made this recommendation: you need to go find a librarian that will teach you, and will work with you, and will help you. And go spend time with them, have them show you how to do this stuff because what they teach you will be invaluable as you build your career and grow as instructor [CAH_2_17_2009].

The Fire Academy’s librarian earned a special place in the instructor participants’ instructional process, and they were aware of the library services. The library’s availability, its collection, its service to the instructor participants, the extent to which it circulated materials and the professionalism of the librarians were all important factors in their use of the library. The instructor participants regarded the library and its resources as an important source of information, supporting research and teaching purposes. In addition, the instructor participants asked students to contact the library if they needed any reference materials. They also encouraged students to “utilize the library at the National Fire Academy.” They found that it is a “pretty easy system to access and pick up information.” Administrators at the Fire Academy, especially the director, have praised the library, recognizing its contributions and regarding it as the channel that links scientific knowledge to street experience, and the research community to the first responder community (The Fire Academy Director, personal communication, November 2, 2009).

As a central institutional source of information, it is noted that the Fire Academy Library is perceived by the instructor participants more as a supplier of formal/institutional sources of codified knowledge rather than as a means by which to manage informal/personal sources of expert and experiential knowledge. Therefore, when acquiring experiential knowledge, the study's findings suggest that the instructor participants consulted their own store of knowledge, social networks and personal collection, rather than the library, as discussed in the next chapter. One instructor participant expressed difficulties and frustration when he explained his subject specialty to the librarian to find information that was within the context. "It would be very difficult to transfer information from the subject matter expertise to librarians. They [librarians] are very good at what they do, but it is difficult to explain what we are really looking for" [TS_3_4_2009]. I will propose practical implications along with recommendations to librarians and information professionals on how to improve services in this area in Chapter 10.

6.4 DIGITAL SOURCES

Besides looking for formal sources of information in print and media formats, and from the library, the instructor participants searched for digital sources of information chiefly on the Internet, as SD explained:

> There are websites on almost everything under the sun now so you can Google about anything. I search Internet first to start something new. There are a lot of classes out there

that might be teaching exactly what you want. Type in some key words; see what pops up [SD_1_27_2009].

In general, the US fire service publishing industry and the fire service community are behind in terms of digital sources and digitization. Lloyd suggested that the formal textual site of codified knowledge can also be consulted through digital sources in Australia (Lloyd, 2007). However, only two instructor participants identified a few online databases in limited subject areas and their use of these sites seemed infrequent. Table 13 shows how few digital sources were found in the interview data.

Table 13. Formal Sources of Information in Digital Format

Digital Source	Sample Fire Academy Program
Organizational Website	. Emergency Medical Service (e.g., Federal Emergency Management Agency) . Firefighting (e.g. Other Fire Academies) . LP (e.g., National Propane Gas Association) . Unified Command (e.g. National Fire Academy)
Online Report	. Firefighting (e.g. National Institute for Occupational Safety and Health)
Online Incident	. Firefighting (e.g. Google, YouTube)
Database	. Firefighting (e.g., National Transportation Safety Board's database) . Hazmat (e.g., CAMEO, which is computer-aided resources; MS Material Safety Datasheet)

According to the instructor participants, information technology has changed the way they look for information. Traditional search routines no longer seem adequate. Indeed, they admitted the change was "dramatic," "amazing" and "wonderful." They "used the web," "punched up something on the Internet" and "Googled" even though some of them thought they were "not computer literate." They believed strongly that there was "a lot of really good information out there," while some of them questioned the credibility and authority of digital sources. Searching online was one of the main ways that instructor participants acquired digital sources for instructional work and they became savvy. They made frequent use of online searches, and most of them often performed the searches themselves. They looked for a range of digital sources, such as all types of firefighter death reports, different organizations' websites on teaching a new course, articles of industry and medical reference, someone else's curriculum that could be tweaked and made to work for the Fire Academy's program, as shown in Table 13.

The Internet was considered particularly valuable for obtaining digital sources in a convenient and timely fashion. WBM pointed out that the Internet made instructor participants' research easier to do wherever they were, at home or at the firehouse. They "don't need physically to be in the library looking for different things" anymore [WBM_2_10_2009].

The Internet is also useful as a basis for problem-solving (Crabtree et al., 1997; Reddy & Jansen, 2008; Sonnenwald & Pierce, 2000) for instructor participants, as GG illustrated in his curriculum development project with his co-instructor where they spent several hours researching digital sources: "There is no need to reinvent the wheel!" They discovered a thermal imaging course with an outside agency that allowed them to look at the outline and get ideas on what they were teaching. When JL put together a firefighting training program of the ten most common cookie-cutter houses in his city, starting from the oldest from the Victorian era and working through around 1980, he looked through probably nearly 1,000 floor plans from Vintage Sears, Roebuck [and Co.] catalogs and different things he found on the Internet**.** He was "constantly dabbling on old house websites, looking at different things, and found pages and pages of old house floor plans online" [JL_2_23_2009].

When the instructor participants were asked to describe any obstacles in the search and use of necessary information, they reported that they often faced "too much" information found on the Internet with stringent time constraints for finding that "right piece" of information to solve problems unique to their own situations. One instructor said, “I don’t put lots of faith on what I found on Internet” [CAH_2_17_2009]. Others were clearly aware of the issue, as another instructor stated:

> We can type something in Google. You got to look at the source where it is coming from. If it is from *Fire Rescue* magazine or *Fire Engineering* magazine, it’s pretty credible… It has to come from a credible source. The thing is the Internet is great. You can get lots of information, but the caveat to that is there is also lots of garbage. Anybody can publicize something on the Internet, fire or EMS related. Just because it is on the Internet does not mean it is right [LL_2_18_2009].

Finding reliable digital sources in the digital world tends to be far more challenging. The amount of information available led to information overload, and field staff instructors had to form coping strategies. For example, they used course objectives and priorities to “compress,” “pare down” and “squeeze” the information they found. They also used class schedule, time factors, personal experience, team instructors and student needs to “cut down” materials.

6.5 CONCLUSION

My study’s findings confirm that field staff instructors demonstrated a similar pattern in using written sources of information as engineers and other professional groups. As discussed in Chapter 3, researchers consistently found that the print sources used by engineers included textbooks, trade journals and technical reports, rather than scholarly journals, books, conference papers and other external sources (Allen, 1977; Shuchman, 1981). My study’s findings reveal that the instructor participants heavily use both internal (e.g., Fire Academy’s curriculum) and external non-scholarly print sources (e.g., NFPA standards). They also seek digital sources of information on the Internet and manage challenges they face effectively.

Unlike what studies found with engineers and listed in Lloyd's textual site, the instructor participants take advantage of media sources, as well as make active use of the library. To them, the print sources serve as the most useful and highly critical source of information, media sources as supplementary teaching aids, and digital sources as the most convenient but challenging in terms of locating reliable information. Similar to the results of the 2007 survey, the study's findings provide strong evidence to confirm that the Fire Academy Library's rich collections and professional librarians have successfully tailored to the instructor participants' high reliance on print and media sources, and the importance of library in their instructional process is distinct.

My study's findings suggest that instructor participants' high demands in codified knowledge is fundamentally dictated by the cognitive knowledge domain learning objectives of KSA in fire service knowledge structures (see Table 1). To satisfy the training objectives, the instructor participants must seek formal and institutional sources of information in print and media formats from the library and through digital sources on the Internet.

CHAPTER 7

INFORMAL AND PERSONAL SOURCES OF INFORMATION

In this chapter, I continue to examine the kinds of information sources the instructor participants sought and used to solve their problems. In the previous chapter, I examined the instructor participants' formal and institutional sources of information, which were codified, institutionalized, publicly available and stored permanently. Garvey (1979) defined informal channels as those that carried information for restricted audiences temporarily, storing it in either one-to-one communication channels or one-to-many channels. Lloyd (2007) referred to the informal source of information in people as the "site of community knowledge" and the "social source," which had the characteristics of being internal, tacit, situated and experience-based. Lloyd's corporeal site included an informal source of information that was "situated embodied knowledge," "tacit and difficult to articulate or to reproduce in textual form" (Lloyd, 2007, p. 188). For fire service knowledge structures of KSA, especially psychomotor domain learning and skills training (see Table 1), the instructor participants turned to their own social network of people, street experience and personal collections as top sources of information, since little written information in the psychomotor domain is available in the library and other places. These sources of information are highly situation-dependent, experience-based and held privately. In this chapter, I investigate the instructor participants' social network of people to identify the key actors and their relationships in the network, the role of street experience and personal collections in instruction. I then discuss how the instructor participants perceived credibility of people and experience, and finally what key factors influenced their choices of information sources.

7.1 PERSONAL SOCIAL NETWORK OF PEOPLE

Personal social networks are one of the most crucial means for exchanging and sharing information across individuals and groups. In every aspect of work practice, “people ask each other who knows what” (Davenport & Prusak, 1998, p. 37). The informal personal social network of people, rather than the formal organizational structure, represents the flow of organization knowledge. Indeed, the network, the source of “know who” knowledge, is a recurring theme in the instructor participants’ descriptions of their approach to problems. According to the instructor participants, besides their own store of knowledge obtained through formal education, training, practice and experience, they gathered job-related information from their personal social network both inside and outside of formal organizational channels. They believed that one had to be a “people person” to be in the fire service business. EE noted that personal networking was “big time, big time” in the business, and he illustrated his broad network that supported his career:

> Seriously… you establish a network if you need something. I have a firm belief that if you need a fireman, you call a fireman… So if you can build that into your support network, I think it makes you stronger as an individual. I had people I like to call that had experience themselves, that I had as mentors, and my father [fire chief], rest his soul. I had other people that brought me along through my career, very energetic people on the fireground, and very knowledgeable people off the fireground, people that have both talents… that I could call and ask questions [EE_2_25_2009].

To describe and analyze the instructor participants’ social networks, I classify sources of interpersonal information into internal personal social networks (i.e., within the organization of the Fire Academy) or external personal social networks (i.e., outside the organization of the Fire

Academy but inside personal life) as shown in Table 14. In other words, the internal sources are a part of the organization of the practice: colleagues, internal groups and students. External sources of information reside outside of the organization of the practice, such as manufacturers and instructors from other states and organizations, along with family members and friends.

Table 14. Informal Sources of Information from Personal Social Network of People

Internal	Sample Program	External	Sample Program
Field staff instructor in the same teaching or curriculum development group	. Auto Rescue . EMS . Firefighting . Fire Investigation . Hazmat . LP . Technical Rescue	Instructor from other state and/or collaborating organization	. Firefighting . Homeland Security . LP . Industry
Field staff instructor in other group	. Auto Rescue . EMS . Firefighting . Fire Investigation . Hazmat . LP . Technical Rescue	Other professionals	. Firefighting . Homeland Security . LP . Rescue Program
Mentor	. Fire Investigation . Hazmat . LP . Technical Rescue	Mentor	. Firefighting . Technical Rescue
Program director	. Fire Investigation . Hazmat . LP . Technical Rescue	Manufacturer	. Hazmat . Firefighting . Trench Rescue
Curriculum Support Specialist	. Firefighting	Vendor	. Trench Rescue
Deputy Director	. Firefighting . LP	Salesman. Technician	. Auto Rescue . Trench Rescue
Firefighter student	. Fire Investigation . Firefighting . Hazmat . LP . Technical Rescue	Friend	. Firefighting
Industrial client	. Confined Space Rescue	Family member	. Firefighting
		Church	. Firefighting

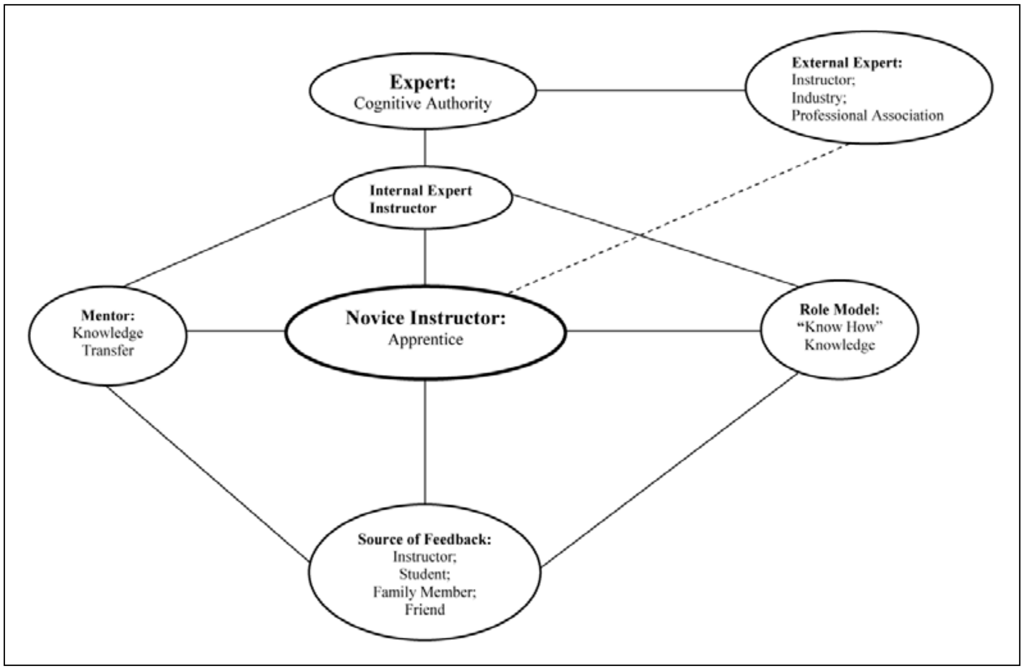
Personal social networks are highly tailored to an individual instructor participant's needs and activities and serve as effective and "instant" information filters. To consult a written record and use other sources seemed time- and labor-consuming as LD elucidated:

> I can send an e-mail to anybody in the world that I feel is an expert in it and say, how do you feel about this, and get some almost instant reaction from him. Whereas if I go to the Internet and look up articles, I got to read them. I got to pull out what I want. If I walk down the hall to the library, I got to go through that. I think they are great as a support or as reinforcement. But I can pick the phone up and call RL and say, "RL, how do you feel about purple widgets?" And chances are RL has an opinion and I respect a lot of RL's opinion. I don't always agree with his opinion, but I can call someone else and get several personal references. I think in my world that is the most important resource because I have a lot of people that I respect. I am fortunate to have a lot of friends that are extremely knowledgeable and willing to give me an opinion [LD_2_17_2009].

In the following sections, I examine four sets of key actors and their relationships in the instructor participants' personal social networks, treating the novice instructor as a central node, as shown in Figure 6. From the novice instructor's angle, my focus is on the identities of these key actors, their respective roles as sources of information and the meaning of their relationships to the novice instructor. The solid lines indicate strong ties between actors and dotted lines represent weak ties. The novice instructor acquires job-related information by accessing experts in and outside the organization; receiving institutional and personal knowledge from mentor instructors; establishing networks through apprenticeship; learning by observing and following role models of expert instructors; and obtaining sources of feedback from instructors, students, family members and friends. I exclude group actors from this analysis, as I will discuss them in

Chapter 8. As I will discuss below, the novice instructor's information-seeking in the networks of various actors is orally based, directed and purposeful. Seeking information is informal and incidental. It depends on the complex interactions of social relationships that novice instructors have developed and maintained on multiple levels, internally and externally.

Figure 6. Actors in Field Staff Instructor's Personal Social Network of People



7.1.1 Expert

Connections in the instructor participant's personal social network are based on shared professional interests and tend to be made up of trusted expert instructors who have the authority to help evaluate information. In fact, fire service training is intensively information based. One of the characteristics of the training is that experienced instructors take on the role of the expert, exchanging and sharing information among instructors, especially novice instructors, and dispensing information to students.

Broad experience in the subject domain of interest is used as a proxy (Wildemuth et al., 1995) for the instructor who is considered an expert. The interviewed instructors defined an expert as either the instructor who had considerable experience in the designated subject area, or who was experienced with similar problems and could tell what he or she had done in the situation. Some instructor participants stated that the expert should be the one who knew more than they did. EE claimed that the instructors' "comfort zone" was the expertise they had spent most of their career in the fire service to build, and they could bring it to the table to share with others [EE_2_25_2009]. Seasoned instructors are regarded as "street experts" because they have done certain things, and they have been in the business long enough to be very knowledgeable. JD described one well-known senior instructor this way:

> People want to sign up for his class because you get so much information from him. He is such a forceful character with so much knowledge. He'll say something in five sentences that is worth a day's training [JD_2_5_2009].

Equipped with the strong knowledge of practice, experienced field staff instructors' professional expertise includes knowing exactly how the information is relevant to training. They are regarded as trustworthy sources of information and reliable points of reference about the profession. As described by Lloyd (2007), experienced firefighters validate ideas, actions, values, beliefs, and emotions of the fire service community. When a junior instructor participant "put together" a new class, it was quite common for him to talk to expert instructors he knew to increase his "comfort level." He searched for reassurance to see if the new idea made sense. LL described how he developed his new class with the help from "a bunch of smart guys:"

> I'm going to ask some real smart guys with lots of experience… I'm going to talk to people mentoring me as a fireman and as a fire officer. I sat down with Chief MC, Chief EE, Chief FR and asked, "What do you think is important for your average street firefighters to know about this condition in a fire building?" So it is like an unofficial poll

> I did…I sat down with a bunch of smart guys to organize our thoughts and create an outline. Then off that outline just started to develop the PowerPoint to match the outline, so my outline is my lesson plan. It was started from scratch, but it was based on experiences from other instructors, what they think is important to cover for this particular class [LL_2_18_2009].

In LL's case, the expert instructors functioned as pointers, directing him to the most important and useful information. They also worked as quality filters, helping him acquire and evaluate the right material. These instructors were perceived as experts who possessed "accurate and useful knowledge" (Morrison & Vancouver, 2000) and cognitive authority, much of it constructed from first-hand experience (Wilson, 1983).

The information expert networks offered may not be what one can capture in a book or online, so the networks become the most effective way to learn and acquire information. The instructor participants saw the experienced instructors not just as experts, but also as resources because "if they cannot answer the question, they would find you the answer" [BF_3_11_2009]. When problems arose and information was needed instantly, if one's own specialization was not immediately helpful, the first step for novice instructor participants was to contact someone who had previous experience and was a specialist in the field. As CD put it:

> So if I had questions, lots of time, rather than go to books or to the Internet, or whatever, I give them [expert instructors] a call on the phone. Even if it is at the scene of an accident, having people you know you can call, and ask questions, get quick answer, or at least they would be able to steer you in the direction to get answers that you are looking for [CD_3_5_2009].

Novice instructor participants knew that they had limited experience, so they had to rely on the expert instructors. The novices collected experts' experiences because they "could not go to read it somewhere else" [CD_3_5_2009]. The novices logged experts' experiences into their mental processes to sharpen their professional skills and knowledge in a way. As MC said, "it's almost like logging it, reading it, writing it back down in your own mental process. You need that because nothing is ever the same in this world" [MC_2_12_2009]. It is noted that the novices also relied on expert instructors to help overcome fear and the reality of dealing with quick decisions on the fireground and emergency scene [EE_2_25_2009].

The Fire Academy is the central point of field staff instructors' highly interactive networks that consist of hundreds of expert instructors inside and outside the state, and who are easily available for information and ready for consultation. Impressively, novice instructor participants learned to develop networks that often had wide geographical coverage of expert contacts. LD described his expert networks across the nation:

> [O]ur peers are around the nation. We just put the question out a couple weeks ago about one of the forms. JG contacted our peer in Oregon and said, "What should we do about this?" And he sent us back his opinion. We could just as easily [have] done it with our peers in Florida or Texas or Maine or New York City… We know people all over the United States. If we don't have the answer, we can go to our peers and move it up and down the chain so that everyone could get the answers and has the support they need [LD_2_17_2009].

Conferences offer an ideal setting for novice instructors to establish new connections with expert instructors who share common problems and to satisfy a multitude of information needs. Conferences provide person-to-person interactions of social networks, information sharing and knowledge exchange. LD described the national conference he helped organize:

> Last year we were able to hold the first Hazardous and Incident Management Team Conference where we had over 100 of representatives from incident management teams all over the United States, from Alaska to Puerto Rico. And we were able to look at common issues that we all had. We put them together into a White Paper and submitted it to the National Fire Academy, and to Federal Emergency Management Agency, Department of Homeland Security. We gained some experience from other teams and other peers and we incorporated it into our class because if it worked for somebody else, then why not see if it works in our state? And usually it does [LD_2_17_2009].

Well-known experts, like John Norman and Tom Brennan, both out of New York, were admired and respected by novice instructor participants. The novice instructor participants wanted to research them, read their articles and look at their books to grasp their attributes. They tried to "pull from" these experts and "mold them into their own vision and reinforce the vision" [EE_2_25_2009].

It is noted that the novice instructor participants purposefully and actively expanded the size and scope of their personal social networks whenever it was needed and often looked beyond the fire service profession. RAV usually used a "calling all cars" strategy when he decided to expand the size of the network beyond the Fire Academy and the contacts that he made through his career [RAV_3_10_2009]. The instructor participants found that talking with experts in other fields helped them prioritize information that had been gained through the literature and other channels and made it into usable knowledge. As CAH illustrated the points:

> I typically look for people outside the fire service because this gives me a well-rounded perspective. I may look for leadership experience, multiple areas whether it's business, whether it's emergency service, whether it's military, whether it's in church. I look for good leaders. I try to take those leadership traits of good leaders and figure out how you can utilize those within the fire service [CAH_2_17_2009].

To obtain external specialized technical sources of information, novice instructor participants acquired it directly from industrial experts, like manufacturers, vendors, salesmen and company technicians, experts in other organizations and instructors from other states. Their relationships with external experts were not as close or as strong as they were with internal expert instructors. One instructor participant invited a vendor to join his class in person to offer specification information on rescue equipment the students were using for training. Others chose to go to conferences and trade shows as they made it part of their work and benefited from connecting with external sources of vendors, as JS summarized:

> Whenever I go to see the FDIC [Fire Department Instructor Conference], I always go through all the vendors there, and I look for information on the education end of it… I always research and look around for anything that is in a learning environment, whether DVDs, books, CDs, interactive multimedia is really good right now. Also there are several companies out there. You can do the individual tutorial; you can work with them and the computer [JS_3_17_2009].

Novice instructor participants were advised to request and obtain information from experts in professional associations. As one senior instructor recommended, "the biggest thing that I'll pass on to new instructors is always stick to the biggest organizations that are within the realm of what you're teaching" because they're "willing to pass us all the information when we need it. They create some of the stuff out there. They have already created half of the world" [MC_2_12_2009]. Experts in fire organizations and agencies, such as the Federal Emergency Management Agency, National Fire Academy, National Fire Protection Association and the National Gas Propane Association, have long been credited with producing high quality and reliable information. Such information becomes more widely available through their Internet presence, and the content is easy to access and use.

Seeking the best quality and most applicable information is a common behavior for novice instructor participants. Expert sources, internally and externally, in and beyond the fire service, serve as accurate providers and suppliers of critical information. The novice instructors' heavy reliance on familiar expert sources is based in part on the nature of the fire service as a fundamentally experience-based profession that faces life and death challenges, and also because of the psychomotor domain learning and skills-focused training in the fire service. The novice-expert relationships, especially novice-internal expert instructor, are strong, close, and complicated. The relationships involve multiple layers of actors internally and externally. The novice instructor is often the one who is the active seeker and user of information received from expert instructors, and these experts who constantly share and disseminate information act as information provider and filter. In the novice instructor's social network, internal expert instructors nurture and cultivate novice instructors by playing roles of mentor and role model as well.

7.1.2 Mentor

As I described in Table 9, one of the roles the instructor participants play is mentor. "Mentoring is huge in the fire service" [EE_2_25_2009]. Mentorship is "basically forever, informally" (The Fire Academy Deputy Director, personal communication, August 23, 2010). It is recognized as key to building a strong social network at both personal and professional levels (Fire Academy Director, personal communication, August 24, 2010), and to developing a satisfying career in fire service training. The instructor participants stated that they never learned anything in the fire service on their own. “Everything I know about being a fireman, being a Lieutenant, being a battalion chief, I learned from other people. That’s how my brain works” [LL_2_18_2009]. Mentoring effectively helps experienced instructors (mentors) transfer personal and institutional knowledge that impacts safety of training and emergency response, operational effectiveness and the transmission of fire service traditions and values (Schrage, 2007) to novice instructors (“apprentice”).

The Fire Academy has developed a structured and rigorous mentoring program, i.e., “train-the-trainer system,” that combines methods of formal training and informal relationship building to help novice instructors develop and make career choices. The system includes both one-to-one and group mentorships. The typical process of becoming an instructor is to be a student of that class first, using the same curriculum and the same objectives, starting from the same level. Then a train-the-trainer instructor (also called a student trainer or student instructor), builds skills based on what others in the past have done, identifies strengths and weaknesses under mentoring and by shadowing expert instructors, develops relationships with the lead instructor and others and finally teaches the class and joins the instructor group formally. The system is very much like an apprenticeship system for training a new generation of practitioners in a skill. All instructors who taught as a group went through the same class as students. WBM indicated that he completed all related training in the Technical Rescue Program as a student to ensure that he was well-prepared to become an instructor:

> As far as the preparation to become a field staff instructor, I have already taken all the classes at least once as a student. Then I went through and took all the curriculum again in Confined Space, Structural Collapse, Ropes and Trenches as a trainer for the local maintenance team. So that gave me a little bit more in depth training, going through it not only as a student once, also as a trained trainer. I've taught in the program by teaching it to the program probably a dozen times, if not more, each year [WBM_2_10_2009].

Novice instructor participants also learned to build a better and more solid foundation with knowledge and information for future career development, as with GF's experience learning cave rescue:

> Over the years BR took me on a number of cave rescue classes, which most people in central America don't even think about cave rescue, but it became such a tremendous background for me to teach not only vertical rescue but confined space rescue because essentially a cave has every possible hazard you can imagine that the man can't create [GF_2_13_2009].

Mentoring is a process and takes a sustained period of time (Bozeman & Feeney, 2007). To ensure a successful mentorship and keep the Fire Academy's training programs running at a consistent level of quality, expert instructors and lead instructors carefully select and handpick apprentices, and they cultivate them through mentoring. Mentors teach apprentices everything they know about the class and program. Mentors bring apprentices in for a period of a time until they "learn the ropes, learn everything they need to know…through time, they will be more comfortable with the class and they can start teaching" [LL_2_18_2009]. The train-the-trainer system is intended to facilitate the transition of a new instructor from student to trainer to instructor, while bridging the gap in institutional knowledge and expert instructors' personal knowledge. It increases apprentices' appreciation for the fire service's history and traditions, offers them a program for career advancement and professional networking and helps them develop critical skills, confidence, and reassurance.

In a mentor-apprentice relationship, ties are strong and tightly connected. Both apprentices and mentors benefit from the mentoring relationship (Kaye & Jordan-Evans, 2005; Malmgren, Ottino, & Amaral, 2010). One of the benefits is that networking happens more naturally through mentoring (Kaye & Jordan-Evans, 2005) at professional and personal levels. To an apprentice, becoming a part of a mentor's network and developing his or her own is central to career development (Pompper & Adams, 2006). The mentor is one of the invaluable actors in the instructor participant's social network of people within the organization. Through mentoring, mentors generously share critical informal/personal sources of information by transferring and disseminating knowledge, experience, skills, social capital and support to apprentices who will eventually become instructors like them. Together, mentor and apprentice shape the fire service training, culture, and operations. Novice instructors are advised to "find somebody who you want to be, seek them out as your mentor, and find out why they do what they do" [BF_3_11_2009] and "watch different teachers, and let them be your positive and negative mentors" [RH_1_30_2009].

7.1.3 Role Model

One way to obtain job-related information for novice instructors is to observe and follow expert instructors as role models. Novice instructor participants acknowledged that they did not know everything, and they were always "students of fire service." Part of their learning was gleaned through informal and formal observations of expert instructors. Their development depended upon the ability to observe expert instructors in teaching and training, which helped them draw pertinent information to develop their careers. They picked up valuable "know how" knowledge, which included not only information, but also manner and technique (Brown & Duguid, 1991). JL described how he "emulated" other expert instructors as "positive role model[s]," and how observation helped him grow into an instructor professionally and successfully:

> What I would generally tell you is to observe other instructors. Be quiet but watchful. Always pay attention. Always observe those folks who seem remarkably successful…I took Instructor I and from that point on, it was a matter of shadowing other instructors, learning from them, watching them, watching how they connect with students, learning the difference between good and bad ways of presenting information that were more successful on the field. I learn from the experience of others… I'm blending things from five and six of individual instructors…So those are the folks I was pulling information from [JL_2_23_2009].

Obtaining information through the observation of role models was critical for novice instructor participants and was an essential part of their instructional-related information activities. They were able to unobtrusively obtain information about how to teach and train by observing target instructors in teaching and training. Such information motivated changes in their behaviors and attitudes. They evaluated the quality of their work and performance by comparing themselves to expert instructors, who were their role models to emulate in the learning of new skills and acquiring new "know how" knowledge. As an information-seeking tactic, Bandura (1977) pointed out the advantages to observing another's behavior, which improved one's ability to mimic others' behaviors. Like workers in organizational settings (Miller & Jablin, 1991), novice instructors used observational behaviors for effective information gathering to improve performance.

By observing and mirroring the teaching and training activities of instructor role models, novice instructor participants obtained the opportunity to become “legitimate peripheral participants” (Lave & Wenger, 1991, p. 32) and were provided legitimate access to the periphery of communication (Lave & Wenger, 1991). They learned to function in the fire service training community, acquired a particular viewpoint and job-related information, and learned to speak the language “with the story lines of the wider profession and the community of practice” (Lloyd, 2007, p. 191). This learning essentially involved becoming the field staff instructor of the Fire Academy and fire service training community, an enculturated (Brown, Collins, & Duguid, 1989) “insider” (Lave & Wenger, 1991). The central issue in such learning is not learning about practice, but becoming a practitioner (Brown & Duguid, 1991). Like machine technicians in Orr’s study (1990), this sort of learning went on in the context of a community where devices were used in the process of understanding and were inseparable from work. Novice instructor participants learned from role models in the context of fire service training where experience-based “know how” knowledge was used in instruction and was inseparable from work. In the strong relationship of role model and student, novice instructors seek role models to follow and job shadow, and expert instructors “show-and-tell” their personal know-how knowledge in a live teaching and training process.

There are similarities in the ways that novice instructor participants interacted with and gathered information through mentorship and observation. In most cases, it was expert instructors as mentors or novice instructors as apprentices who adopted proactive stances, reaching out in the community and making initial contact, asking questions and trying to interpret and act on information in their situation. Novice instructors are not isolated; learning in fire service training is fostered by providing access to experts, mentors, and role models, and by developing professional networks. It takes considerable time and effort for novice instructors to become recognized members of the fire service training community and to build strong and broad personal social networks. To novice instructors, it's like launching a new career with a fresh identity of themselves.

7.1.4 Sources of Feedback

Unlike other forms of information, feedback is about the self (Morrison, 2002, p. 231). In the interpersonal realm, feedback involves information about how others perceive and evaluate an individual's behavior (Ashford, 1986, p. 465). Researchers have recognized that feedback is an information resource that enables employees to reach both organizationally determined and individually held goals, and feedback seekers focus on obtaining accurate and valuable information (Ashford, 1986; Ashford & Cummings, 1983; Fedor, Rensvold, & Adam, 1992; Morrison, 2002; Morrison & Weldon, 1990; Vancouver & Morrison, 1995). Researchers have built on the literature on feedback by considering a range of types of information that employees seek (Louis, 1980; Miller & Jablin, 1991; Morrison, 2002).

In this study, I found that novice instructor participants considered three kinds of feedback sources available to them: students, instructors, and personal circles of friends and family members. They received feedback from the students to identify weak areas not only with the course evaluation questionnaire, but also by talking to students during breaks and getting to know them throughout the course. Students actively shared feedback after the training programs ended. One student excitedly informed his instructor about how he applied what he learned in the class into the real world, which made the instructor feel very rewarded and proud.

A student in the class called me up at 6:30 in the morning and said what your guys taught me in the Fireground Command Officer School worked! He said, "I had a fire at midnight. This is what I did and it went great! Your guys taught me about being a fire officer. If you had not taught me that stuff in that class, I never would have made the decision I made last night" [LL_2_18_2009].

Novice instructor participants were open-minded and humble in teaching and training, and they encouraged students to share their personal experiences in the class. They learned new things from students since students told things differently, and "they explained something in a way I had never heard before, and suddenly they were teaching me. I'm a student. I feel that I understand students well in this business because I am one of them" [JL_2_23_2009].

Instructors' timely and effective feedback is critical in teaching and training since it ensures the quality of their instruction. Some instructor participants considered instructors' feedback more important than the students' feedback because instructors had more knowledge and experience. The instructors' feedback helped novice instructors identify new needs and enhance curriculum development in areas they had not thought about or taught before [CD_3_5_2009]. Novice instructor participants got feedback from each other as co-instructors, like BF and RL in preparing the course of Fireground Management School for Small and Volunteer Fire Departments. They obtained feedback from other instructors on instructional techniques. They often sought other instructors' feedback to increase productivity of their instructional work so they did not waste time to "invent the wheel," as BF explained:

My personal approach is that I am going probably to talk to some colleagues who have gone the same path and found what a successful thing was. Quite often, they are going to give me books they read, or an article they read, or a video they viewed that helped. And

> quite often, it will just be personal experience… I found I am much more productive when I just model what someone else has done and who has been successful [BF_3_11_2009].

Family members of novice instructor participants in the fire service are important sources of information within their personal social networks. As I mentioned earlier, some instructor participants were motivated to apply their personal loss to the development of a class called Saving Our Own. Other instructor participants have family traditions in the fire service going back as far as four generations. The instructor participants often consulted with their family members in the fire service to gain feedback. One instructor's fire chief father guided him through his career. "And so if I get something on my mind, I don't want to talk with my wife and anybody else. I'll go out to the cemetery, and I will talk to him. I know he can hear me" [EE_2_25_2009].

Novice instructors admitted that soliciting feedback and making changes is "a long process." Even after they have taught the class for a couple of years, they are still adding and taking stuff out. "Things never end. We are still searching for the best piece of information" [GG_3_10_2009].

As found in previous studies, individuals are encouraged to make feedback inquiries because of the potential benefits for reducing uncertainty and enhancing performance (Ashford, 1986; Morrison & Cummings, 1992). The more that an employee values achievement, the more effort he or she will be willing to put in to obtain feedback (Trope, 1975). It has been demonstrated that novice instructor participants seek different amounts and types of feedback from their students, instructors, family members and friends. These sources differ from one another in terms of expertise, accessibility, etc. Feedback seekers are motivated, at least in part, to obtain accurate and reliable information (Ashford & Cummings, 1983), and sources with high expertise are best able to provide such information. Expertise of instructors was a definite consideration for feedback seeking by novice instructor participants with a high need for successful and safe training, and it was the most valuable source of feedback they went after.

Feedback seeking is goal-oriented and the key information activity for the instructor participants. My study's finding and prior studies agreed that proactive feedback seeking is an important individual resource for employees (e.g., Ashford & Tsui, 1991; Morrison, 1993a, 1993b; VandeWalle et al., 2000). It is not just part of the "loop" as Leckie, Pettigrew, and Sylvain (1996) modeled, but it is one of the important informal sources of information that enables instructors to evaluate and improve the quality and relevance of their instructional work and to facilitate information exchange and sharing. It helps enhance their work performance and increase productivity.

As illustrated in Figure 6, in the novice instructor's social network of people, he develops strong relationships with four sets of actors -- internal expert instructors, mentors, role models and sources of feedback. These relationships carry different levels and depths of information. Among them, relationships with external experts are weaker due to less frequent inquiries and the limited scope of information that it provides. Seasoned instructors at the Fire Academy play the role of expert by sharing and disseminating cognitive authority of knowledge to novice instructors. The seasoned instructors also play the role of mentor and create reciprocal relationships between mentor and apprentice. Mentors transfer institutional and personal knowledge to apprentices to help them develop professionally. Expert instructors are observed and followed as role models by novice instructors while sharing and demonstrating of "know how" knowledge. Expert instructors, along with students, friends and family members, are the main actors who provide feedback to help modify novice instructors' behavior and performance. In the network, it is clear that internal expert instructors are the principal providers and suppliers of instruction-related information, which is the most easily available and accessible. Playing multiple roles, they are the most critical and influential actors in the network. And, in novice instructors' information-seeking in the network, the novice instructor acts as seeker, receiver, user and beneficiary.

7.2 PERSONAL STREET EXPERIENCE

I discussed earlier that "street experience," a term commonly used by participants in this study, plays an important role in fire service training, as shown in Tables 1 to 3 and Figures 2 and 3. As suggested by the profile data presented earlier, instructor participants had considerable experience in the profession. Moreover, the interviews revealed how their professional lives are colored by diverse experience. The number of years in service was a common determinant of a fire service instructor's experience, abilities and skills. "Years are used as a requirement" [TS_3_4_2009]. The instructor participants stressed the importance of street experience in their work practices and indicated that accumulating deep experience took lifelong learning and practice. Gaining information from street experience becomes critical for the construction of meaningful instruction for students. Street experience of individual instructors helps fill in gaps in the instructional process, and it is the link between knowledge (cognitive domain) and skills (psychomotor domain) learning as shown in Table 1.

Street experience in the fire service is a form of experiential knowledge that is "tacit" (Polanyi, 1998), as opposed to explicit knowledge. It is "in the head" [MC_2_12_2009] "know how" and procedural knowledge that is difficult to articulate and codify. It is why "we can know more than we can tell" (Polanyi, 1967, p. 4). Personal knowledge about someone's own practice is deep, sensitive, contextualized knowledge derived from the "wisdom of practice" (Schulman, 1987). Such situated, embodied knowledge is tacit and challenging to articulate or to reproduce in textual form (Lloyd, 2007). RAV stated, "Experience is knowledge. It is something that seasoned instructors have done. They have learned. They have seen. The book is the core knowledge. It is so important so students understand concepts and things, but somebody has to try that. Something works or something doesn't work, or something is too dangerous and you shouldn't do it at all. Experience and knowledge of doing things is probably the most important in the fire service" [RAV_3_10_2009].

In this section, I explore in further detail the role that street experience plays as an influential informal source of information in instructional practice. Working for the top-ranked hands-on fire academy, the instructor participants reported drawing on experience for different purposes. Some relied on past personal experience to make sense of their curriculum development and to find ways to better develop it, while others described the important insights they learned from the real world, and instructional techniques of employing storytelling, that assisted them in getting a handle on their information needs in teaching and training so they could train firefighters effectively and safely.

7.2.1 Personal Street Experience in Curriculum Development

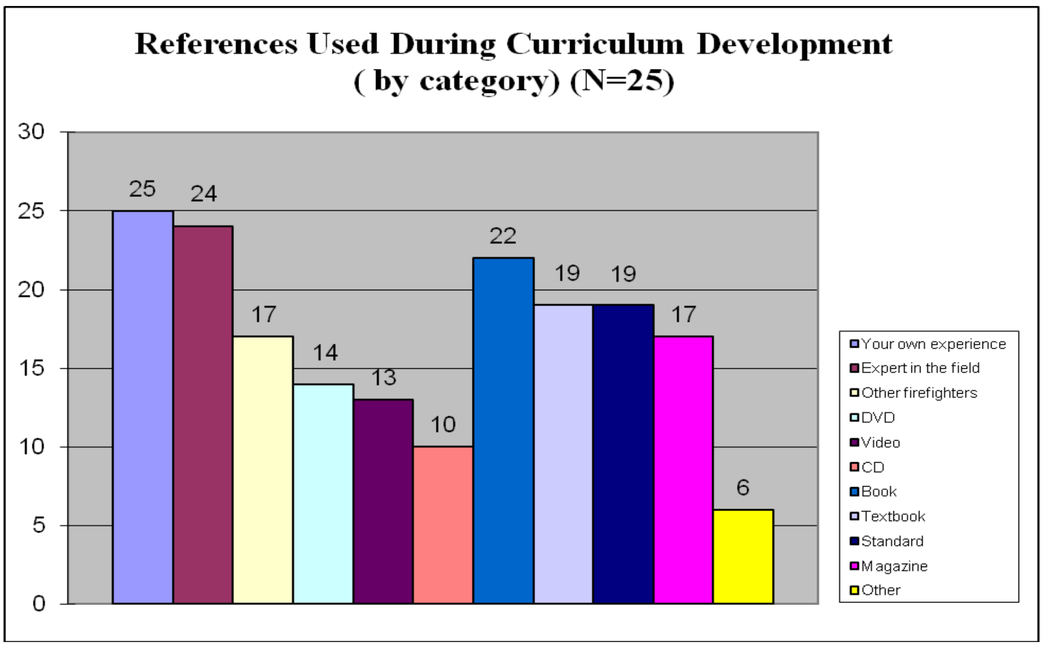
The Fire Academy Deputy Director pointed out:

> The heart of the Fire Academy's curricula development is driven by the practicality and real world experience of the field staff instructors. The Fire Academy invites the most experienced "street expert" instructors to design specific curriculum since they have the most experience, knowledge and skills in that area, and they understand what the students must know or be able to do in actual incidents. Then curriculum and drills are written to

address these needs and how best to teach the knowledge and skills (The Fire Academy Deputy Director, personal communication, July 15, 2008).

The instructor participants reported that they frequently put together new curriculum objectives and developed new classes based on their own personal experience. Personal experience was used heavily in curriculum development as shown in Figure 7, which was generated by the profile. All 25 instructor participants consulted personal experience during curriculum development.

Figure 7. Personal Experience as Source of Reference in Curriculum Development



The instructor participants described how codified and formal knowledge (such as standards and objectives) gave instruction the “dry” structure (bone), the fundamental information, and informal knowledge, particularly personal experience, gave the “interesting” substance (meat). They had to “take the concept out of the textbook, and then develop objectives, so during their development of those concepts or the objectives, they add experience to those objectives” [TS_3_4_2009]. LL described how he and his team instructors used a variety of their own personal experiences to develop and enrich the Fire Officer classes for Management I, II, III and IV:

> We get the stuff out of the textbook. We develop curriculum on what the objectives [from the State Fire Marshal Office] are. But a great portion we do is personal experience, the experience level of the instructors, everybody that works as fire officer, fire chief, battalion chief, company officer. We rely on our own personal experience. Myself, I rely on my experience as battalion chief. I bring that to share with guys [LL_2_18_2009].

More common across the sample are insights pertinent to the information instructor participants needed that were also gathered from group members' experience. I will discuss them in more detail in Chapter 8.

7.2.2 Personal Street Experience in Teaching and Training

Fire service training is consistent with craft learning, as the fire service training culture is more "kinesthetic" and "hands-on doing" [JRs_2_18_2009]. As apprentices learn the craft of their masters through observation, imitation and practice, so do instructors train new instructors and firefighter students. Craft learning is something that is acquired "at the elbows," on-the-job training, rather than in books (Ryle, 1949; Schön, 1983). Firefighter students learn tricks of the trade by doing them and by getting hurt along the way [MM_2_26_2009]. "Firefighting is traditionally much like a trade. Experiential learning is the main focus. I learn by doing this. I learned by going to the fires. I learned to swing an ax by swinging an ax, or I learned to put out fires by putting fires out" [TS_3_4_2009]. Responding to the emergencies, like firefighting in the fireground, is a different story from reading a book, where you are only grabbing some of the basic thoughts and theories [MM_2_26_2009]. "Whole different thing! You have to physically experience it" [LL_2_18_2009].

The instructor participants further illustrated how they taught, demonstrated, and passed on skills to firefighters through hands-on training by actually "seeing or touching," and requiring from the beginning to the end a "step by step, inch by inch" process [RH_1_30_2009] like a "show-and-tell" [JWR_2_25_2009]. By redundancy, instructors trained and developed students' skills and competency. And it was amazing to the students that "they did it in class, and they did it at home [fire department], and it worked at home when instructors were not there" [JD_2_5_2009].

The bulk of the Fire Academy's program is hands-on. 70% of the programs are hands-on, and in some programs it is even 90% (The Fire Academy Director, personal communication, August 30, 2010). "Doing a fire behaviors demonstration, showing students the difference between a fog and a straight stream and how it affects the behavior, instructors can just talk about it. But until they go and show students how it really worked, they cannot see the effect" [JRs_2_18_2009]. A lot of "basic ingredients" of hands-on and physical work in instructional practice have to come from instructors' life experience and years of street experiences. If instructors limit themselves only to the textbooks and publications, "there are some real life experience and skills missing." As RP explained:

> As a field staff instructor, you are given curriculum to present and the objectives are already predetermined [for a canned course]. A lot of times that relies on the instructor's experience and expertise to add to what the outline and the objective says. In another words, without some real life experience as a real life example to add to it, it's just reading a slide or writing on the board for students. So in as much as the objectives are already predetermined, it's what I bring to the class as well as my fellow instructors from experience and other education that makes the difference [RP_2_19_2009].

Across the entire sample, the instructor participants reported that they drew upon their "own personal experience" and "feel" to perform their instructional work with "confidence" and "comfortableness." They are always in love with the "hands-on stuff, the getting dirty, getting results, doing things other people cannot do, helping people." To them, "that is a great reward" [EE_2_25_2009]. This informal source of information of personal experience is readily available 24/7. It depends on years of work service in fire service training and the subject interests the instructor holds. The higher seniority and longer years he or she has, the richer experience the instructor possesses. Senior instructors' teaching can just go out off the top of the head [MM_2_26_2009], and it can also be "just jammed full of experience and real life stuff that may never ever happen again on the fireground" [RH_1_30_2009].

Personal experience is also critically important to make training effective and safe. I observed a Trench Rescue training class led by WBM in a real controlled training environment. A dangerous situation WBM described in his interview did occur that day when I was present. The instructor's comfortable level of personal experience is absolutely a must to ensure safe training, as WBM explained in his interview and reiterated his points at the scene:

> When we are 6 or 8, 12 feet down below the soil, we are putting in stable, trench shoring, or working in around a trench shield box. That is as real time as it's going to get. As students work down and instructors work up top, we explain how this all gets assembled. The soil is constantly moving. Something bad can happen so when we teach trench especially, I get all my instructors. When I am on the lead, everyone is asked to be focused, to be very comfortable, to be confident with their knowledge, and to be able to stop operations because we get lots of students that try to work outside the safety parameters. And we have seen huge sections of soil, the size of a car tumbling over.

> Someone would be in that area, and it is going to be fatalities. We cannot have that… With rope [rescue training] stuff, we get secondary safety system, like secondary rope on students, so if something should fail, we get back up. But we don't have that with trench stuff, so we really have to be careful when it comes to that. Yes, it is important to have experienced instructors, knowledgeable instructors, and confident instructors that have good credibility [WBM_2_10_2009].

It is crucial to note that personal trial and error is another aspect of street experience, not only about what worked, but also what did not work. Showing students what not to do proved to be an invaluable means of instruction, such as in the Saving Our Own program I discussed earlier. Failed efforts, mistakes, and lessons learned are important points of learning that increase awareness retained by students for future responses if they find themselves dealing with similar situations. By talking about what instructors did and their mistakes, instructors open the door for more people to "share their experience and things" [RH_1_30_2009]. CAH talked frankly about his mistakes with students to show what went wrong and how it could be fixed:

> I would say I learned the most in a situation which I probably did not handle [in a] right way. It is very important to say to my students. Let me [show you] what I did here and how I screwed up. What happened? This is what led me up to make that decision. You know it was a wrong decision. Learning from personal mistakes was a real teacher for me when I heard [mistakes] from somebody else. I tried to do that to my students, bring the experience, and let them learn from my successes and from my failures [CAH_2_17_2009].

Personal street experience is learned and shared by communication with other instructors and students directly and in person through hands-on training and in storytelling. "[T]he type of things, the type of leaning [in fire service training] because it is so complex, it almost has to be embedded in a story sometimes” [TS_3_4_2009]. Vezeau (1993) defined storytelling as a descriptive, not numerical, narrative and had the capability to effect personal change of narrator and audience through communication with “immediacy and relevancy.” Oral traditions in fire service training are strong. Instructor participants indicated that they “do more verbal than anything.” They spent much of their time communicating orally using stories to share their experiences that are mostly included without documentation. None of the training drills’ “know how” and procedural knowledge is written down; they are all based on oral tradition and therefore not subject to academic standards [TS_3_4_2009]. JS explained why storytelling was an effective tool to show his “experience or tricks of the trade” in his teaching. He used “energetic stories” to describe his experience from both positive and negative perspectives so his students related to his points better and got the most out of their learning:

> So when you are teaching a subject, and that particular evolution, say ladders into a window, you get to discuss your experience. This is what happened when I didn’t do it right, or I did do it right and the outcome was really nice. So you have that positive and negative stuff you can draw on. This kind of story is very compelling and powerful because the students receive that way better, and they know that you have done it so they can relate to you more [JS_3_17_2009].

Storytelling helps instructors bring home the point and makes it relevant to students. The storytelling is very important for personalizing the whole situation in the field for students and makes students feel like they were there [HG_3_2_2009]. Students will remember and apply the points during their emergency response. They will also remember the stories, narrators, people involved and the events that occurred. Those stories will become part of informal/personal sources of information.

There is a strong sharing culture among fire service instructors, who pass on their personal experiences to students. Personal storytelling in teaching and training was a powerful tool that helped instructors articulate their experiences, evoke emotional responses and make points. RH and his team instructors shared their touching stories about firefighter fatalities of loved ones:

> That was back in 1997 or 1998. There were 11 instructors from here who had either lost a relative or a friend in the line of duty. We started sharing in the class some of those losses and the impact from it. For instance, my brother BH, also a field staff instructor, and I would share about the death of our father who got killed in the line of duty. BH would share that he got burned seriously in the fire, and he shared that they went down. We both share how that impacted or acted in our family life, and things of that nature in order to get across the seriousness in what we were doing. Eleven of us then put the class of Saving Our Own together and developed the techniques and structure on how to teach it. So we taught it here as a train-the-trainer class. And people from all over the country came, took the class, and took it back to their states. Then basic training on firefighter survival techniques came out of our program that went into Fire Academy programs [RH_1_30_2009].

In recounting salient aspects of their own street experiences, the instructor participants skillfully framed them into stories they wanted to share with other instructors and students: “If I have some more specific information, maybe on a specific rescue that we have done, or maybe some pertinent specific information from a prior experience of teaching, I’m always looking to share that and pass on that" [WBM 2_10_2009]. The instructor participants also shared stories about others to appreciate fire service culture, duty, tradition and pride, and to enhance group identity. EE referenced stories of Congressional Medal of Honor recipient, Colonel Joe McCarthy, medal recipient of World War II, who walked the battleground and the fireground, and BH, who has been highly decorated in his city fire department as hero [EE_2_25_2009].

With a strong oral tradition and verbal culture in fire service training, most of the knowledge shared and taught may come from someone's experience that is being passed down for generations. Most of what instructors teach, "Probably it came from somebody's brain, and it came from somebody's experience…that's how we got a lot of information… Fire service things have been passed down from generations to generations" [LL_2_18_2009]. Stories have been passed from old to young and transformed into collective knowledge and "collective discourse" that is constituted by complex stories about fire practices, culture, norms, values, and the profession. These stories are woven together to form a cohesive view of what it means to be a professional firefighter (Lloyd, 2007). The instructor participants are not concerned about copyright, because it is usually difficult to trace down who told the story first, and on the other hand, the original author intended to share it anyway, as BF explained:

> We call it "stealing." I'll "steal" all your stuff. I'll tell a story one time, and within two weeks you may hear the story leaking out the door. It's the same story. We don't care. If the story is effective, use it! You know it is not like it is my story, you can't tell them. We share everything. We share experience. There have been plenty of times we say, you know, I have never done this. But LA tells this story, and I'll tell it. I am sharing his experience. We share everything, absolutely! [BF_3_11_2009].

The instructor participants were teachers and trainers at heart. As such, it was impossible for them to imagine not sharing what they have learned with students. And it was in the spirit of learning and teaching that they brought forth their passion through storytelling. The instructor participants emphasized that they did not tell stories for the sake of telling stories. They tried to use stories to teach students things, to tie that story to the objectives that they were trying to cover, to conceptualize what they were trying to accomplish, and to teach students to be better firefighters. Storytelling contextualizes instructors' personal street experience through the events, symbols, pictures and actions of others. Word of mouth transactions are recognized as being context dependent (Solomon, 1997; Talja, Keso & Pietilaninen, 1999; Tuominen, Talja, & Savolainen, 2002; Turner, 2009) as the instructor participants' storytelling was highly specific and contextual. Storytelling proved to be a powerful tool in fire service training that facilitated students' psychomotor domain learning and skills training.

It was noted in the interviews that the Internet certainly has given instructor participants a venue where they can readily access, disseminate and share their own personal experience with each other. Fire organizations sponsor email lists, chat rooms, electronic forums, and blog spaces where instructors can interact with one another. The instructor participants described how they interacted with others via email, on listservs and blogs, and in other online environments, summarized in the following table.

Table 15. Informal Sources of Information in Other Channels

Channel	Fire Academy Program/Course
Shared Drive at Fire Academy	. Confined Space Rescue . Cornerstone Program . LP (Liquid Petroleum) . Trench Rescue
YouTube	. LP . Firefighting
Blog	. Firefighting
Listserv	. Firefighting

Usage of these channels was a new trend, and the change is occurring slower with some instructor participants than others. It was observed that those who claimed that they were not computer literate did use shared drives and listservs, but they rarely mentioned that they used YouTube and blogs to search, exchange and share information.

My study's findings suggest that most Fire Academy's training programs are documented and standardized in curriculum, but little information is available in writing about experiential knowledge that the instructor participants hold individually, embedded deeply in practice, and available and accessible only by them. Similarly, Hertzum and Pejtersen's (2000) case studies and other studies of engineering design suggested that little information was available about the context of the design process and the reasons for adopting the chosen solution among the available alternatives, even though the resulting technical solutions were usually well documented. Effective access to such information about the project depended on contact with a person who was involved in the original design process. Information from personalized street experience was highly valued by the instructor participants who believed that no one could learn the fire service business just by reading about it. Their information-seeking in this context was deliberate and purposeful.

7.3 PERSONAL COLLECTIONS

In my 2007 survey, field staff instructor respondents ranked personal collections as one of the top sources of information. The interviews provide me with more evidence and detail about personal collections, as privately owned and personally organized materials available only to the instructor him/herself, that meets his/her unique needs and is usually stored in his/her office, home (e.g., basement, garage), or in both locations. I group personal collections under informal/personal sources of information since they are not institution-based and institution-organized. The present investigation is limited to the collections that have been cited as used for instructional purposes. The collections are usually developed over a long period of time throughout the owner's career from a variety of sources and in a variety of ways. For example, the instructor participants collect new books from classes and trade shows (such as FDIC), class manuals by taking courses, and policies and procedures from fire departments. The size of collections among the instructor participants ranges from several items to a couple hundred. The collection is small and is only related to the subject areas in which the owner specializes. One instructor participant's collection fills up a full garage. Another instructor designed his new fire chief office to hold the collection.

I discussed some of the printed materials found in these collections in Chapter 6, such as books, trade journals, course books, course notebooks, and curricula. The collections also contain media materials, such as pictures and videotapes. There are unique items held nowhere else, such as local fire departments' standard operation procedures, and pictures and videotapes captured by the owners themselves. Table 16 presents types of materials and associated subject areas, assembled by the instructors in their "little nice" collections. The composition of the collections includes both informal (unpublished) and formal (published) materials.

Table 16. Composition of Materials Mentioned in the Personal Collections

Type of Material	Subject Area
Print	
Book (Textbook)	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue
Files in Binder	Firefighting
Classnote	Firefighting
Manual	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue
Standard Operations Procedure	Firefighting
Trade Journal	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue
Trade Journal Article	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue

Table 16 (cont.)

Type of Material	Subject Area
Media	
CD-ROM	Technical rescue
Picture (Photo)	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue
PowerPoint Slides	Emergency Medical Service, Firefighting, Fire Investigation, Hazardous Materials, LP, Technical Rescue
Videotape	Firefighting

There are not many differences based on subject area in the distribution of materials in the personal collections, and the instructor participants did not like to weed their collections but rather enjoyed saving everything for a lifetime. The instructor participants tended to rely on books, and their collections reflect this. Books hold permanent value and are not easily discarded. Books and other printed materials, particularly trade journals and class manuals, make up the majority of the contents of all the instructors' collections I interviewed. However, one instructor participant developed his private collection essentially focusing on videotapes with a couple hundred different videos.

The collections are arranged in unique ways. For example, CAH uses binders and has kept the collection in file cabinets for 25 years: "I have major headings and categorize the collection by alphabet. For example, under A, it's Americans with disabilities, apparatus placement, anatomy/physiology, child abuse, fireground accountability, agricultural fire, agricultural rescue" [CAH_2_17_2009]. RL creates his collection over 30 years and keeps it in a two-car detached garage: "Two walls in that garage are shelved with every binder, every book I have had for 30 years. So everyone is categorized, and every video is categorized" [RL_2_11_2009]. WBM uses "old bins" to organize his collection of books and trade magazines. EB did fire investigation for 25 years. He has built his collection to filter information and integrate his knowledge with that of others in the field. Such integration requires years of experience, personal network, and high technical knowledge. He described how he developed and organized his collection:

> For particular program areas that I have worked in, I have a great deal of information just in my own files, some on paper, some on electronic. My personal collection is probably the most important source of information because it is based on those other issues. I accumulate information from others, from my other instructors, and from different sources, and as I put them in my collection, it reflects all of those sources. Again as I enter or keep certain information in my collection, I have filtered it through my own -- what I think is important, what I think is needed for my classes. My resource tends to be a little strong on my experience [EB_3_10_2009].

The arrangements of their collections are highly individualistic and reflect the interests and work habits of the owners. The instructor participants were satisfied with their personal collections, which comprise material that is directly relevant to their needs. They used the collection that was handy for reference and often the place to go first. For some instructor participants, if there was something they could use from their own collection, they would draw from it and then decide where to go next [RL_2_11_2009]. If something they were looking for related to a course they took or taught, they would try to search relevant books and manuals in their collection, since they saved “everything from instructional activities” [SD_1_27_2009].

Even though the instructor participants had access to the Fire Academy Library and other libraries, they still went ahead and built their personal collections in order to have desired information sources at hand, infrequently counting on libraries. One instructor participant stated that he used his personal collection first “because it is faster for me to rely on what I’ve already got,” as he keeps every single class that anybody ever gave him in a PowerPoint or CD in his collection [JD_2_5_2009]. Another indicated that his first thought was to ask, “Is what I am looking for something I have been involved with before? If it is, I would go to my personal collection to get my mind thinking. Although things change, there are certain things that are always there” [RL_2_11_2009]. WBM goes to FDIC (trade show) every year. He gets all kinds of materials on rescue and new materials on fire. He has three dozen different reference books at home from different fields.

> Some of the books I read, some of them I have not. I got them in case it’s something I need as far as personal reference. I use a lot of stuff for career development and promotions in-house with my fire department. I share that information if I’ve got a new instructor. I am finding it is very valuable to have that personal reference list and resources that are in my house. I do not have to say, this class is coming up and call down to the Fire Academy [WBM_2_10_2009].

Obviously, the personal collection provides the most immediately accessible and the most familiar source to the instructor owner. Soper (1976) affirmed that physical accessibility was an important predictor of information source use in a personal collection, and it affected the selection of citations, which are indicators of this use. Woodburn (1969) suggested that printed material existed in four levels – the personal collection, the departmental library, the university library, and other libraries away from the institution, but the most-used material was in the personal collection.

There was almost complete agreement among the instructor participants that the possession of personal collections was regarded as necessary in most subject areas. This study’s findings are consistent with what Soper (1976) found. The collections are generally much smaller than the libraries and lack much of the diversity and depth that are the strengths of the

Fire Academy Library, but they are easier to use and add to. They are smaller and less complex. They are arranged to meet and reflect the special needs and interests of their owners.

Firemen's love for tradition and history is reflected in the collections they have built, as described by JS:

> It is one of the things with firemen that history and tradition is so important, especially to a lot of the older firemen. My father was a fireman, my son is a fireman, my wife's grandfather and uncle were firemen. It's very traditional. I collect all sorts of fire department stuff. As firemen, we collect history. We like to remember the history of the fire service. I collect history books, fire service books. A lot of books that came out right after 9/11 my family get me as gifts. From my previous department, I have a lot of stuff that I utilized over the years, like standard operation procedures. I still have those. Magazines, I keep all magazines that I've got because they have a lot of good resources in there. No, I'm not a throw-away person. I might be able to use it again [JS_3_17_2009].

Numerous studies have shown that various types of professionals found their collections to be the most accessible physically, partially due to familiarity (Allen, 1977; Allen, Gerstenfeld & Gerstberger, 1968; Hertzum & Pejtersen, 2000), and used those collections even if the information was rather limited (Allen, 1977; Bowden, Kromer, & Tobia,1994; Gralewska-Vickery, 1976; Hogg & Smith, 1959; Prentice, 1980; Rosenberg, 1967; Shuchman, 1981; Soper, 1976; Woolf & Benson, 1989). Some researchers, however, argued that current perceptions of physical accessibility might be changing due to the proliferation of electronic sources (Fidel & Green, 2004; Marshall, 1993). RP donated his entire collection to the Fire Academy Library and indicated:

> Through my career, I saved everything, all my books, and manuals. In every class I reference them, many a time, and I thought that was valuable. Now it's so easy to go on the Internet to find those same things without having to keep the hard copy, I thought the hard copy is better kept with the Fire Academy Library [RP_2_19_2009].

7.4 PERCEIVED CREDIBILITY OF PEOPLE AND EXPERIENCE

As indicated by the above discussion, people and experience are important sources of information for the instructor participants in this study. They are highly personal and individualistic sources of information. The stories from the instructor participants documented in this chapter raise important questions about the perceived credibility of informal/personal sources. Experienced instructors are typically thought of as expert, authoritative sources of information.

During the interview, I asked the instructor participants to rank their three top information sources. Fifteen placed personal experience "right to the top." Ten were from the Firefighting Program, two from Hazardous Materials, one each from Emergency Medical Service, Homeland Security, and Technical Rescue. BF explained why he ranked experience as the number one top source:

> It is because all the reference materials in the world is somebody else's work until I can utilize that and make that my own. A person who has honestly learned something the hard way through his experience is very passionate about it. The experience has to be the most important [BF_3_11_2009].

Six of the instructor participants ranked people and experience "hand in hand," as equally important top sources of information. Among them, five were from the Firefighting Program and one LP (Liquefied Petroleum). Their experiences are based on what they have done at work, but also the people surrounding them. As LL stated, “my resources are the people. My resources are the experience” [LL_2_18_2009]. The remaining four instructor participants ranked personal collections as the most importance source of information, three from the Firefighting Program, one in Technical Rescue (See Appendix P).

Beyond the perception that information from peer instructors is more “real,” the instructor participants shared experiences in which they were able to gather information from peer instructors that they believed would be accurate information that is not available from any other sources. They conveyed the strong confidence they had in their fellow instructors’ credibility, as RAV described:

> I always depend on the same people I rely on because I am confident they are a good source of information. I rely on a group of people I work with, and I am very comfortable working with them, and they work with me a lot. So I can ask them for a source of information that’s timely, and also they are a trusted source of information. That is important. So you are expecting the information you get from them is going to be accurate [RAV_3_10_2009].

The instructor participants perceived people and experience as credible sources of information. All of them described having profound respect and trust for their peer instructors’ experience, because “they did it,” “they have done it,” and “they have been there.” Other instructor participants indicated that the unavailability of information led them to turn to expert instructors and personal experience for information in the event of a pressing problem or immediate need. Credible information from people and experience was seen as being the easiest, most accessible, and often the most relevant to the work problems the instructor participants faced.

7.5 FACTORS ON SELECTION OF INFORMATION SOURCES

An important question in information-seeking is which source a seeker should consult, because source choice decisions directly impact the outcome of information-seeking (Xu, Tan, & Yang, 2006, p. 1666). For the rationale behind the information seeker's choice of information channels, some researchers have found quality of source to be more important in driving information-seeking (e.g., Ashford, 1986; Bronstein & Baruchson-Arbib, 2008; Morrison & Vancouver, 2000; Swanson, 1987; Vancouver & Morrison, 1995; Xu, Tan, & Yang, 2006). O'Reilly (1982) and Anderson et al. (2001) developed the following four items to assess quality of information sources as summarized by Bin (2009): 1) accuracy of information; 2) relevance to one's work; 3) timeliness of information; 4) importance to one's work. These categories are applicable to the instructor participants when they evaluated the quality of information sources. Their information-seeking preferred the source when it offered quality and relevant information.

My study's findings indicate that the instructor participants put a greater priority on quality than on accessibility when selecting different information sources because they were more concerned with finding the right source to solve practical problems at hand than considering costs and/or efforts. The accuracy of information was the most decisive factor for the instructor participants when choosing an information source. "That piece of information" must be of high quality because it ensures safe training, and firefighters take it home and will apply it to actual life-death emergency response. My study's conclusion coincides with other researchers' findings on quality of source (Bronstein & Baruchson-Arbib, 2008; Orr, 1970; Xu, Tan, & Yang, 2006). As I reviewed in Chapter 3, contrarily, studies found that engineers generally followed the "principle of least effort" by choosing information sources on the basis of ease of access.

7.6 CONCLUSION

In this chapter, I present the informal and personal sources of information that include instructor participants' internal and external networks of people, street experience that is highly contextualized in daily work practices, and personal collections they assembled to satisfy their special needs. My study's findings reveal the importance of networks of people and personal experience as significant sources of information, particularly when instructors have immediate needs and limited time, or when information is not in writing. As I explained, these informal/personal sources are influential. They are accumulated throughout a career and are used heavily in the instructional work. They are developed, constructed and organized by the instructors and emerged from the instructors' work practices and personal lives. In other words, in drawing on their networks of people, personal experiences, and personal collections, the instructor participants literally serve as their own major source of information.

The instructor participants actively seek and use interpersonal sources internally and externally. They prefer to talk when interacting with and accessing interpersonal sources, similar to what was found in other studies (e.g., Case, 2007; Daft & Lengel, 1986; Huotari & Chatman, 2001; Leckie, Pettigrew, & Sylvain, 1996; Mackenzie, 2005; Taylor, 1991; Turner, 2009; Wilkinson, 2001). They rely on the personal contacts within their respective subject areas; i.e., their "know who" knowledge is an essential source of information. These findings are consistent with decades of reviews and studies (see, for example, Chen & Hernon [1982] and relevant study review in Chapter 3) that document a strong preference among information seekers for interpersonal sources. The most heavily used sources in organizations are two types of personal information sources (internal personal and external personal) (Byström, 2002; Chakrabarti, Feineman, & Fuentevilla, 1983; Choo, 1994; Hardy, 1982; Hertzum & Pejtersen, 2000; Yitzhaki

& Hammershlag, 2004). As Case concluded (2007), people use formal sources rarely, instead gathering and applying information from informal sources, chiefly friends and family, throughout their lives (p. 8).

Relying on personal relationships for information involves the relational dynamics of information networks as social processes. Such person-to-person information activities have made information-seeking and sharing more productive and satisfying for the instructor participants. Researchers have a long-standing interest in mapping social networks as channels for obtaining information (e.g., Crane, 1972; Cronin, 1982; Haythornthwaite, 1996; Hersberger, 2003). Haythornthwaite's (1996) network exposure concept focused on the ways in which individual network characteristics increased the probability of a person's exposure to information. The concept may shed light on examining how characteristics of each individual instructor participant's network affect their information-seeking and sharing behavior. My study offers insights into the importance of interpersonal sources for instructional information acquisition from just one actor's angle. How this behavior happened interactively within the social life of the instructor participants is beyond the scope of this study, but worth further investigation by attending to the perspectives of all actors within social networks.

Across the interviews, the instructor participants described two types of street experience that they drew upon in their efforts – their own and team instructors'. They recognized the importance of other instructors' experiences as they admitted that there are lots of things they have not done yet that someone who has been in the business longer than them has seen. They had to "gauge a lot of information" and "borrow" experience from other experienced instructors [CD_3_5_2009]. Chakrabarti, Feineman, and Fuentevilla (1983) found that work groups in industrial R&D were the most frequently used information source and were perceived to be the most helpful of all provided information sources and second highest in terms of availability and ease of use. In the next chapter, I focus on exploring how collaborative teamwork affects each individual instructor participant's information-seeking and sharing behavior.

CHAPTER 8

GROUP NETWORK-MEDIATED SOURCES OF INFORMATION

> We are so much family oriented. It's the way we behave. Our whole being is interacting. Being in the fire service for 31 years now, that's all I know. I would never think of and develop something on my own, without running it by my peers. I don't have all the ideas and the answers [RP_2_19_2009].

In my previous two chapters, I examined how individual instructor participants used formal and informal/personal sources of information to solve their information problems. In this chapter, I continue to explore instructors' group network-mediated sources of information and study how collaborative teamwork affects an individual instructor's information-seeking behavior. To understand instructor participants' collaborative information sharing and seeking, I examine their information processes in groups, the transactive memory system as an informal source of information and multiple forms of collaborative information-seeking. Lloyd's (2007) "site of community knowledge" did not explicitly include collaborative teamwork as a source of information. For fire service knowledge structures of KSA, the instructor participants utilized group network-mediated sources of information to support learning in all three cognitive (knowledge), psychomotor (skills) and affective domains (e.g., teamwork, trustworthy, appreciation) (see Table 1). These types of informal sources of information are tacit, context-dependent and specialization-specific. Information-seeking in this context is directed and purposeful.

As I illustrated in Chapter 2, field staff instructors are geographically distributed but do not perform their work in isolation; many other actors and network members are involved. Collaboration is established based on shared interests, and collaborative groups tend to be made up of trusted colleagues who have the recognized expertise to carry out the work together. Field staff instructors are linked together and groups emerge around a class, a curriculum project or a common interest in specific subject areas. Maintaining group memberships is complicated and hard. Instructor groups often function as very closed systems. Getting inside requires participating in the train-the-trainer system and learning, training and working together, usually over an extended period of time and within the context of the culture as I discussed earlier. Group members interact in complex ways as they develop strong and effective work routines. Like the "group mind" conceptualized by Wegner, Giuliano, & Hertel (1985), the important characteristics of instructor groups include similar attitudes, similar values, similar views of the world, shared language, and otherwise seemingly unitary outlooks. The group members intend to behave and think as a unit.

Of the 25 instructors I interviewed, all worked in groups one way or another with various degrees of involvement. A majority of them showed individual instructors were highly collaborative. Only two stood out for their individualistic approach because of the courses they chose to teach. As the preceding discussions demonstrate, the fire service community is homogeneous as members come from comparable backgrounds, have equal abilities and share interests. Orasanu & Salas (1993) defined groups as homogeneous with interchangeable members with respect to expertise, roles and responsibilities. The members of the groups in this study are diverse with representation from different types of fire departments (e.g., paid, paid-on-call, combined, etc.). The need to count on each other in times of uncertainty with risk and danger ensures closely knit and trusting relationships among instructor group members; the instructor participants in each subject domain share a coherent set of beliefs and values, following unified professional standards and guidelines. The groups are usually managed and coordinated by a lead instructor. The complex group system also includes a structure without a group leader in the well-developed groups that were established a long time ago.

The instructor participants' network-mediated information sharing and seeking among groups is embedded in their instructional activities. Field staff instructors are required to frequently perform team writing and team teaching and training at the Fire Academy, "gang teaching and writing" [LD_2_17_2009], with at least two or more instructors involved. During the curriculum development, RP bounced ideas off a co-instructor since they oftentimes came to the point where they had two good ideas. "So the team concept to me is great" [RP_2_19_2009]. Team writing and teaching "give students a better way to interpret. Just like with the Butterfly knot, my experience is the best way to tie this into a Butterfly. The other guy goes, 'Well, this is my best way to tie.' It's the figure eight. Let the student figure out what experience is best for him" [JRs_2_18_2009]. Like "drill," "task" or "skill" stations in training programs at the Fire Academy, TS described team teaching and training in the Firefighting Program where he assigned instructors to teach in skill stations. The more complicated tasks required more instructors. The ratio of the number of instructors to the number of students was determined by the complexity of the skills being practiced:

> Typically, we have two instructors to teach what we call "skill station." Because of the complexity of what is being taught, for live fireground training, it needs to be limited to no more than ten students [one instructor to ten students]. It is the maximum. Students have to physically have involvement in the drill in order to take some meaningful experience away from that training. As far as planning who is teaching together, it is more successful to have knowledge of instructors and understand their personalities, their strengths and their weaknesses, their styles of communication, and their styles of

> teaching. If two instructors are at odds or don't have a rhythm together, then it's a very limited experience for the students [TS_3_4_20009].

JD's group used a similar approach to take advantage of team instructors' abilities and strengths since they demonstrated different methods to help students achieve the same goal and understand the concept better, with more options to look at and choose to fit their own styles.

> Auto Extrication is 40 hours. In the first day in the classroom we talk about all the goals. In the second day we do hand tools. The students are broken up into three groups. They go to this instructor to learn how to do this objective with this hand tool. They move to another instructor to learn the same exact objective with this hand tool. Three different ways doing it that reaches the same goal [JD_2_5_2009].

The instructor participants believed the best way to work at the Fire Academy was to work in teams. They found that it was "very valuable" to work with groups because no one could have all the information. "I put my two cents in and this guy here puts his two cents in, and hopefully we build the student up, and give him two sides to look at" [JRs_2_18_2009].

8.1 GROUP SIZE AND COMMUNICATIONS

Research on group memory processes suggested that groups were superior to individuals for different types of memory measures (Clark & Stephenson, 1989; Hartwick, Sheppard, & Davis, 1982; Hinsz, 1990; Stewart & Stasser, 1995; Vollrath et al., 1989; Yarmey, 1992) because the storage capacity of groups was "group size," which was bigger than that of individuals (Hinsz, 1990), and groups benefited from the larger storage capacity (Laughlin, VanderStoep, & Hollingshed, 1991). Moreover, the expectation of working together on a collective effort may influence how group members process information (Karau & Kelly, 1992).

The instructor participants obviously believed “two heads are better than one. That is probably the most critical elements in it. It is a team effort” [LL_2_18_2009], but just as group members differed in terms of their expertise, knowledge, skills, and experience, group sizes varied considerably from two-person to 25-person teams, as shown in Table 17. Several participants were from the same Firefighting Program, but they worked on different teams. See classes involving the instructor participants in team teaching and writing in Appendix Q. Appendix Q indicates that the instructor participants who worked in the team writing project tended to stay in the same team and teach the same class.

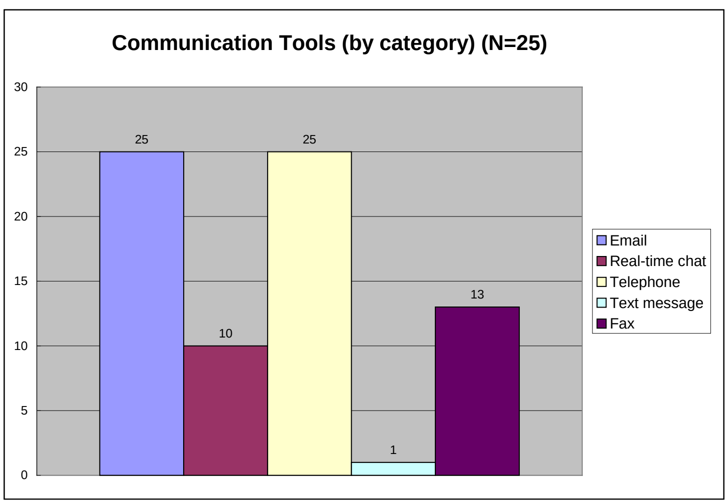
Table 17. Group Size of Field Staff Instructor Participants

Program	Number of Group Members
Mass Casualty Triage	2
Firefighting	3
LP	3
Online	3
Industrial	3 or more
Confined Space Technician	4
Firefighting	4
It Crashed in Your Backyard	4
Firefighter Orientation	4
Safety Officer	4
Confined Space Technician	5
Unified Command	5
Cornerstone Program	5 or 6
Fire Officers	5 or 6
Hazmat	5 or 6
Auto Extrication	6
Fire College	6 or more
Fire Officer	6 or more
Fire Investigation	6-7
Structural Collapse	7
Fireground Officer Commander School	10
Industrial	10
Saving Our Own	11
Fire Academy	12 or more
Fire Prevention Officer	12-15
Structural Collapse	22
Firefighting	25

The instructor participants’ groups were interactive and task-oriented. As groups were established, members developed common ways of seeing and interacting with each other. They created a group culture to sustain development, formed a group identity and conducted various group activities. In their multiple group memberships, individual instructors learned to be “bona fide disciplinary practitioners” (Messer-Davidow, 1993). Depending on the field staff instructor’s experience, knowledge and interest, and also the needs of the Fire Academy, he or she can have multiple memberships across subject areas (The Fire Academy Deputy Director, personal communication, August 8, 2008).

In terms of communication tools, the data in Figure 8 generated by the profile indicate that all instructor participants used email and telephone the most, which was generally matched with the findings from the 2007 survey. The telephone seemed to be the tool that the instructor participants talked about as if it was an indispensable part of the instructional process. “Calling” was used as the primary means for obtaining information from a network of people.

Figure 8. Communication Tools Used by Field Staff Instructor Participants



The instructor participants talked explicitly about sharing information and doing cooperative work electronically. Electronic communication seemed to be facilitating long-distance cooperative work and increasing the rate of information exchange for a number of instructors. One technical rescue instructor participant talked enthusiastically about encouraging instructors to communicate by email throughout all the different programs so that they stayed prepared if they were going to make an assignment for someone to teach a specific course subject [WBM_2_10_2009]. For the Cornerstone Program, there were five to six instructors. They met four times in the past year but relied on emails. RL kept every email and printed them out, so he had hard copies to prove if they argued about something. “Email settles disagreements very nicely” [RL_2_11_2009].

Teamwork naturally facilities discussion, both formal and informal (Gralewska-Vickery, 1976), and communication is vital to the processing of information in groups (Hirokawa, 1990; Innami, 1994; Von Cranach, Ochsenbein, & Valach, 1986). Across the cases, I found that most instructor participants preferred “sitting down” or face-to-face interactions for regular meetings, such as discussion meetings during curriculum development. During program teaching and training, the instructor participants preferred a brief meeting in the morning, a lunch meeting and one at the end of the day for group feedback. And at the end of the course, they had a group meeting. Two weeks and two months later, they met and discussed what they had done [JD_2_5_2009]. JL offered regular “little informal meetings” and meetings in informal settings during lunch in the Firefighter Academy program to keep the lead instructor and group members informed. One instructor member explained, “We bounced ideas off each other for tweaking our approach and evaluating the effectiveness [of the class]” [JL_2_23_2009]. JS offered the reasons why he preferred face-to-face meetings more than email and phone, reflecting the oral tradition and practice in fire service:

> We made small [face-to-face] meetings. Emails are OK for quick [communication]. I don’t type so I really can’t communicate well with long emails. I am always like quick

> sentence. So most of the time, I prefer if we can just discuss, and I think discussing face-to-face is even better than through the phone [JS_3_17_2009].

Having face-to-face meetings appears to be one of the most appreciated and valued features of collaborative information sharing and seeking. In the meetings, group members have things in common with each other, and they share a sense of place. The commonalities lie not only in subject interests and backgrounds, but also in problem-solving and action approaches where instructors feel part of a closely-knit community that shares common issues, interests, solutions and goals. Many instructor participants considered small groups' specialized meetings as critical personal contacts for keeping up with information and finding the solutions related to the immediate requirements. For them, these meetings were an extension of the information activities that took place in their personal networks, but the manner of information exchange was more action-based and problem-solving oriented. It was "a lot of talking to other instructors" and "bouncing ideas off each other" that helped them learn how best to interpret a particular piece of information or make a good decision. The exchange and sharing of information through face-to-face meetings proves to be central to the instructional process. Face-to-face oral communication has obvious advantages since a communication process can get group members talking about the same thing concurrently and make the process productive and satisfying. Gralewska-Vickery (1976) suggested that engineers valued personal communication highly and these characteristics apply to the instructor participant groups as well:

> Important characteristics of a personal face-to-face encounter are its immediacy, instant feedback, uniformity of media…In a direct communication the precision is much higher because the relevance of the spoken message can be adapted to the direct topic of

conversation; the recall is also higher because of the interaction between the two persons (Gralewska-Vickery, 1976, p. 270).

Allen (1977) summarized the role gatekeeper engineers played in R&D organizations as I discussed earlier in Chapter 3. The existence of gatekeepers also come across in other studies (e.g., Agada, 1999; Baldridge & Burnham, 1975; Barzilai-Nahon, 2008; Coleman, Katz, & Menzel, 1966; Crane, 1972; Klobas & McGill, 1995; Meadows, 1998; Rogers & Shoemaker, 1971; Schwartz & Jacobson, 1977; Shoemaker, 1991; Shoemaker et al., 2001; Sundquist, 1978; Tushman & Katz, 1980; Whitley & Frost, 1973). My study identifies “star” field staff instructors (i.e., high internal communicators) who serve as lead instructors or group leaders and play the valuable role of “gatekeeper.” They are not only technical experts, but also “referral” experts (Bernier & Yerkey, 1979). They are strongly connected both internally and externally. As intermediaries, they mediate between formal and informal networks (Booth & Owen, 1985). They explain, filter and reorganize the content of information they receive before disseminating it to their group members.

8.2 COLLABORATIVE INFORMATION SHARING AND SEEKING

In this section, I focus on characteristics and patterns of the instructor participants’ collaborative information sharing and seeking behaviors through their information processes in groups, transactive memory systems as informal sources of information and multiple forms of collaborative information-seeking.

8.2.1 Information Processes in Groups

Some instructor participants worked in self-managed groups like what Lawler, Mohrman, and Ledford (1992) and Manz and Sims (1993) discussed of self-managed groups in corporate settings. Others worked in groups that had a lead instructor or group leader. In either case, instructor members had developed strong and effective work routines. They often "bounced ideas off each other," identified problems and set goals together, and then reached a group consensus. For example, LL's group sat down to determine what they wanted to teach within a class, how they wanted to deliver it and what they thought was important: "Once we all came down to a consensus of what was important, we put it together and developed the program. When we have disagreement about stuff, it comes down to what is the consensus the group thinks. We stay within the group to solve disagreement" [LL_2_18_2009]. Some groups, as large as 22 persons, were managed as a "family business," having family meetings and talking up their problems within the group [MM_2_26_2009]. The Firefighter Academy group had a number of instructors (six to eight) on any given day, but on the weekend there were only two instructors, as GG explained how the group managed the change of group dynamics:

> As far as the big group, typically we would get together and identify the problem and brainstorm ideas. Sometimes as easy as saying "who's the lead for the day to fix the problem?" Sometimes it might not be that easy. We didn't plan for this kind of problem. It was complicated. So we got together. We tried to brainstorm. Because we are in the program, we typically can figure out within our group [GG_3_10_2009].

When MC and his three-person team developed a new program, he liked to throw out ideas to the other two members, JJ and BB. He needed a "collective bargaining mindset" and ideas from them. He asked for their feedback to see if he was going down the right path before the group really built the program. He continued:

> Actually, JJ came down here. We sat, did the meeting, and went through a little storyboard on what we wanted it, how we wanted it, laid out the flow to make sure students would understand it. So he was involved more in person. BB was involved more

with email. “I’m emailing you this section, read this section. It outlines what we thought, what we talked about. Kick it back to me.” We tried to do this about a month [MC_2_12_2009].

Instructor group members were encouraged to give their opinions of what they thought, and the group made a few changes accordingly. It definitely went back and forth because everybody had an opinion on it. The group would try to pick up on the best [JS 3_17_2009].

On the other hand, the instructor participants went beyond the group boundary to look for information. The instructor group usually had strong networks of their own, as one instructor indicated that they had a group of 50 to 60 instructors in the Hazmat Program. If instructors encountered problems that the group could not solve, some instructor at the program level might know the answer [CD_3_5_2009]. LL’s group looked for information beyond his group expertise for the Fireground Officer Management School Program. They wanted to do a scenario that involved a tornado that came to the town, like a natural disaster, something different from fire. They were going to use the collapse pile at the Fire Academy’s rescue facility for the scenario, pretending a tornado was going through town and running a big rescue operation. However, none of the group members knew how to do it. They found resources and asked the Structural Collapse Program Director for help. He started to teach them. LL concluded, “We don’t have all the answers, but we know where to get them. We just go to other resources to bring them into the group and get the information for us” [LL_2_18_2009].

Another instructor and his group ran into a stumbling block and then took advantage of their network. One of the things the instructor participants always did was to email out asking, “Do you know anything about this? Can you point me in the right direction?” Or they made a phone call if they had a friend in another department. “You definitely network with each other to see if they have ideas or at least the direction to go in" [JS_3_17_2009]. JR's group made a lot of calls to OSHA to clarify what they meant by their standards and asked what OSHA liked to see, since they had to meet OSHA standards for the Industry Program. They also called some other people who they knew worked in confined spaces and asked them about their stuff [JRs_2_18_2009]. JD's rescue program group looked for information on aircraft, technical rescue cases, and foam information from various manufacturers, because people made foam differently and the foam reacted differently [JD_2_5_2009]. The groups filtered out what they had because they received a lot of information.

One instructor participant described his group members as strong-willed subject experts in the same area; they knew the objectives by heart, and all of them had experience. All of them thought their experience was the exact way to do it, and all of them were meeting the objective but had different means of getting there. "That's harder." Instructor participants learned to give up and compromise sometimes. They remembered, "the goal is that students leave with…this core set of knowledge…It is OK to teach in three ways to learn the same goal" [JD_2_5_2009].

Instructor participant groups were task-performing groups that became information processors (Hinsz, Tindale, & Vollrath, 1997). The groups increasingly performed cognitive tasks (see Galegher, Kraut & Egido, 1990; Salas et al., 1992; Walsh & Ungson, 1991; Weick & Roberts, 1993). The processing of information in groups involved activities that occurred within and without, as well as among the minds of group members (Ickes & Gonzalez, 1994). The instructor groups' activities demonstrated a number of different tasks similar to what Hinsz, Tindale, and Vollrath (1997) suggested: group brainstorming led to ideas generated; group problem-solving brought out plausible alternative solutions; group judgment resulted in the evaluation of alternatives; and group decision-making included the selection of alternatives;

group interaction and discussions provided internal and external feedback to group members about ideas, preferences and solutions. The primary task of a decision-making group was to reach a consensus (Stasser, Kerr, & Davis, 1989). This consensus was typically built on the exchange of information, particularly when the task has an intellective flavor of attempting to discover the true or correct answers (Kaplan & Miller, 1987; Laughlin & Ellis, 1986). The instructor participants have established an effective group structure to help facilitate information exchange and decision-making processes. Groups were context sensitive and context situated by their nature (Levine et al., 1993), and all information and decision-making processing in the instructor groups took place in specific contexts.

8.2.2 Transactive Memory System (TMS) as Informal Source of Information

In this section, I discuss how a transactive memory system existed in the instructor participant groups and how group members accessed and utilized it as an informal source of information during the instructional process. As I reviewed in Chapter 3, a transactive memory system developed in the group (Wegner, 1987) consists of specialization, coordination and credibility. Well-developed transactive memory systems in groups have greater knowledge specialization (Wegner, 1995). Effective group performance relies upon the group members' ability to access, communicate and use accurate information held by its individual members to improve a group's information integration and decision-making processes (Cannon-Bowers & Salas, 2001). Researchers compared information processes between groups and individuals (Chalos & Pickard, 1985; Doise, 1969; Hinsz et al., 1988; Walsh, Henderson, & Deighton, 1988; Weldon & Gargano, 1985; Whyte, 1993) and concluded that groups held a more complex perspective regarding a set of information than individuals did (Neale et al., 1986; Whyte, 1993). All instructor participants insisted that "the most valuable asset" they have had within the training programs was rich experience and the diversified expertise of instructors. As one instructor proudly stated:

> I have probably 30 guys working in my program. Probably 15 of them can write a book. It's very high talent level on very high experience level. Collectively if people get together to share all of their experience, outcomes are going to be more well-rounded [LL_2_18_2009].

The instructor participants have developed a shared and combined knowledge system based on different domains of subject expertise and experience. The group members were clearly aware of others' knowledge, as seen in how LD's team worked out their teaching assignments:

> There are several instructors because we have one instructor for each team. And we have up to five teams. And if we have an instructor, like LA, that is a real-world incident commander, or a couple of our other instructors that are incident commanders, we will let them teach that portion of incident command. I typically teach the safety officer portion because that is my position in the state's incident management team. It all depends on the makeup of the training cadre [LD_2_17_2009].

When LD and his team instructors initiated the curriculum, they used the National Fire Academy documents as a starting point. But when they enhanced the curriculum to include local and state enhancements, they had to tap into a wide variety of personal experiences of group members to "get a bunch of information" so the group was able to tie information together and incorporate that into lectures and activities:

> Seven or eight of the incident management teams went and job shadowed in California at a wildland fire. And they went with people who were hired to manage the fire. And they came back and brought those experiences. And a number of our instructors went to New

> Orleans for Katrina. We use those experiences all the time, saying in New Orleans this is what was occurred, this is what they are doing. Plus a number of us went to the flood last year in the state all up and down the Mississippi, and the Fox and a number of different rivers. Plus there is another class at all hazards incident management teams, and these are National Fire Academy instructors who are commanders, planning chiefs and operations chiefs for 20 and 30 years from all over the nation, and they can relate some of their experiences on how it occurred for them, and it allows us to come up with our own ideas to say "let's do this in our class" [LD_2_17_2009].

During the instructional process, instructors "bounce ideas off each other," offer unique expertise to each other, and work on achieving the same training mission. LL stated:

> [Instructors] complement each other's experience in a sense where if I have something unique that has happened, something that is a life experience at work I can add in, it will complement something else someone is talking about. You know, it is a team effort. It is a team of experienced, well-qualified individuals who bring their experience to the table to build the program" [LL_2_18_2009].

Instructor members are mutually aware of each other's areas of expertise and the limitations of their own knowledge at the beginning of the instructional process. WBM offered the most eloquent description of the transactive memory system involved in developing a new program and how individual instructor members accessed information from one another. His group is highly technical and efficient where the communication is easy and natural, even though the instructors come from different departments and communities. Previous experience working with different instructors is a clear advantage:

> BC is the lead instructor. BC, myself, JS, RR are the four key personnel. BC works on the bulk of the program. It's a brand new curriculum. Obviously, BC has taken lots of information from other classes, using that to build on that so we have a pretty good program to start. We have to look at four different people's field work. Like JS, he is very knowledgeable, probably more knowledgeable in hazmat material, which is a bigger component. BC assigns all hazmat materials stuff then monitoring stuff to JS. I essentially am given lots of rope stuff, setting up some of the field skills and field challenges. BC gets a broad base perspective on the program. He is working on lots of administrative forms, paperwork, lots of NIMS guidelines, NIMS paperwork as far as from the incident commander's perspectives, how they would record lots of the information whether it is evolution, whether it is a real time response. He gains lots of his information from his place at work from a local fire department. RR is being assigned some specific information for some of the vendor equipment, for communication equipment, some of the SCBA training stuff, and ventilation equipment as far as review that and contact vendors. Basically we look at the whole program, we figure out who would have skills sets, which would be most comfortable with these information or these areas, and then we assign that [WBM_2_10_2009].

The instructor participants are resigned to the fact that their knowledge of outside areas will always be limited. "Some guys are better at one topic than the other, so guys gravitate towards their specialty that works well," if they are together [RP_2_19_2009]. Instructors need to utilize the experience of other instructors because others have done things that they have not done. It is adequate for information to be accessible through someone else's expertise and experience. For example, in team teaching, JL described how the team instructors took advantage of each other's specialty strengths:

> We know each other very well, obviously, all of us. Different guys have different areas of specialty. Some guys are tremendously gifted at knots and ropes and everything with that. Other guys have extensive background of respiratory protection. So when it comes to anything related at SCBA or air systems and that kind of thing, I have got a natural background there. We know these things about each other so clearly. If I knew my partner was better at the ropes than I, I would function more as an assistant and he would function more as the lead. And he and I would have that discussion ahead of time. Likewise if it is a SCBA, I know that they're going to yield to me and want me to answer the majority of questions, and then they would assist. So generally one guy will take the lead and keep things rolling. The other guy would be the assistant [JL_2_23_2009].

The instructor group members are counting on one another's expertise. They develop non-redundant knowledge, increase expertise, and learn how members' knowledge matches together. The prominence of expert domains can motivate other members to quickly take charge for other areas, optimizing knowledge assets (Lewis, 2003). The instructor participants are often grateful and respectful for their members' niche.

"The transactive memory system begins when individuals learn something about each others' domains of expertise" (Wegner, 1987, p. 191). Different from the transactive memory system in which *over time* team members learn the distribution of expertise within the team (see literature review in Chapter 3), instructor participants are usually assigned expert roles that are associated with specific domains of knowledge, experience and credibility, and they are able to implement a cognitive division of labor that promotes use of members' unique knowledge. In other words, the transactive memory system is already in place *before* the group starts performing the tasks and it helps enhance the group performance. Instructor groups possess a well-defined transactive memory system and group members are aware of other members' strengths and weaknesses, which help groups reduce their task coordination and increase productivity (Austin, 2003; Wegner, 1995).

Typically, it is the lead instructors who consciously build the system from a pool of excellent expertise by handpicking instructors to assemble the groups, based on their unique specialty before the group starts to function. Learning and understanding every team member's job is "like an orchestra, if you are playing violin in an orchestra, you should know what the next person is going to do" [LL_2_18_2009]. Prior to teaching, training and curriculum development, the lead instructors often ask key questions, like where the instructors come from, what their strengths and weaknesses are, how that measures up with each member's strengths and weaknesses. In his team writing, one instructor participant as lead instructor divided categories of subject expertise into different committees and then handpicked instructors. He assigned one committee to work on Tactics and Strategy I and II, another committee on Instructor I and II and a third committee took care of all the management classes. "Each guy will be assigned different topic areas based on their experience. In order to get on that team, or that committee that rewrite the class, you have to have some pedigree and credibility behind you" [LL_2_18_2009].

With his team's teaching and training requiring a high degree of specialization, JS identified his team instructors' "expertise" and allocated them among different drill stations based on the comfort levels they indicated. He explained:

> The students rotate through six drill stations. The instructor usually stays at one station. This way they are consistent about what they are doing. Every instructor has a little

> personal expertise on what they want to do. I cooperate with the instructors and work with them on what they normally like to do at the station. That's what he is very comfortable with. He has a little bit of insight, his tricks of the trade [to show students] [JS_3_17_2009].

TS had sharp eyes and built files when he handpicking his people for his program. Like other instructor participants, he hired people who have a tendency to be excellent in one or more areas of the subject. Some of them are very good at engine work, some are good at truck work, some know a lot about SCBA, others know a lot about hydraulics [TS_3_4_2009]. There are some topics people are more confident in than others. That is "basic firemanship" [EE_2_25_2009].

Specialization is the key element that allows the instructor participant groups to function as an effective memory system and achieve superior performance. Their transactive memory systems consist of clear specialization distribution among group members; credibility, experience and expertise are earned through years of practice and rigorous training. Specialization is an important aspect of the transactive memory system since it enables the team to make a more efficient use of the collective knowledge (Lewis, 2003). Hollingshead (1998a, 1998c, 2000) stated that specialization leads to a more efficient and organized investment in information retrieval, prevention of information redundancy and accessibility to a wide range of expertise. It is important for work groups to have a shared conceptualization of the distribution of knowledge within the group to achieve effective performance (Hollingshead, 1998a).

In this study, each lead instructor is the master and central node of a group's shared knowledge structure, as they know potential members when they are students of the program. They handpick them through the train-the-trainer program to their "strong suits" of expertise and experience, explicitly assign responsibilities for specific subject domains to complement each other and coordinate information processing. As RP emphasized, "Team teaching needs a good leader, a lead instructor who can say who is going to divide up the responsibilities and hold each individual instructor accountable for what they are supposed to do" [RP_2_19_2009]. "We all come from different backgrounds, but we are all going to the same end. We all have strengths and weaknesses. The group leader puts us together, and makes us a team" [JRs_2_18_2009]. One senior instructor participant has a group of 22 instructors with changing group members in any given day of the program:

> Initially I was handpicked to be brought into this program, and then after that I was one of the people that have a say on who was going to be brought in to the programs. Every one of those instructors, basically the individuals, are the instructors who pick the instructors. Every one of them has been through the program. If there is a need to add somebody, they basically pick the person that they want to add, and then they know if it works, then I'll put them on there. The core of the group has probably been together for 15 years. The name changed. The basic attitude and the philosophy have not [MM_2_26_2009].

The lead instructor knows who is coming down, what their strengths are and what reputation they bring to the program. They can walk in and integrate quickly into the group, and it is seamless because of the familiarity with one another: "They are just comfortable with one another. Everybody knows everybody contributes, everybody knows what areas are an individual's strong points and it just comes together" [MM_2_26_2009].

Lead instructors skillfully "play off each other," "blend" a broad cadre of instructors into their group priorities and "match up" instructor members' comfort zone of expertise. TS described his handpicking of instructors as “like dating.” “We are trying to find out the right match for the right person. Instructors, for example, not all, but someone from a very, very large city, may not necessarily do well teaching rural volunteer firefighters. The fit is just not there” [TS_3_4_2009]. Hand picking individual instructors for a good “match” is an appealing and common strategy to ensure a balanced distribution of expertise and experience among group members. Lead instructors’ personal knowledge of expertise helps promote and reveal unshared information (Stasser, Stewart, & Wittenbaum, 1995). Knowing what other group members know, like the lead instructor, can increase each member’s access to information and can have a direct impact on the quality of members’ work and group decisions (Hollingshead, 1998c). The lead instructors have an important and direct impact on how the group’s transactive memory system is being built, maintained and updated, and how members retrieve knowledge and information from it.

The instructor participants rely on the transactive memory system as an important informal source of information while they perform collaborative information sharing and seeking. When group instructors with different levels of expertise and experience interact with each other during the instructional process, instructor members gain an entirely different outlook, and students “come up with the really rounded education and learning process and experience” [RAV_3_10_2009].

8.2.3 Multiple Forms of Collaborative Information-Seeking

As discussed above, the processing of information in instructor participant groups involves activities that occur inside and outside the group. My study’s findings reveal the instructor participants’ collaborative information-seeking takes three forms as shown in Table

18. Among them, Veinot's (2009) two forms of "joint information-seeking" and "tag team information-seeking" were identified in the instructor participants' groups.

Table 18. Forms of Collaborative Information-Seeking by Field Staff Instructors (Source: Veinot, 2009)

Form of Information-Seeking	**Sample Fire Academy Program/Course**
Joint Information-Seeking (two or more people together for external and internal sources, especially interpersonal sources)	Firefighting; Hazmat; LP
Tag Team Information-Seeking (shared need but searching separately for external and internal sources, including people sources)	Emergency Medical Service; Firefighting; Hazmat; LP; Online Firefighting; Technical Rescue; Unified Command System
Intra-Group Information-Seeking (shared need and searching information within the group to access and utilize group network-mediated sources of information, especially the transactive memory system)	Emergency Medical Service; Firefighting; Hazmat; Online Firefighting; Technical Rescue; Unified Command System; Fire Investigation; LP; Structural Collapse; Industrial Firefighting

Veinot defined "joint information-seeking" as two people simultaneously seeking information together from external and internal sources, in particular emphasizing interpersonal sources. RP and his partner used this approach for a two-person team when they were on a curriculum development project:

> Sometimes we go together, sometimes we go separately. We use a lot of references. We are in the library for hours. You know, videos, books, Internet, incident reports, and news, news clippings, and news information. We look at something like an earthquake or a hurricane that devastates a section of a coast. Those are the magnitude of incidents that we are looking at [RP_2_19_2009].

Veinot (2009) named the second form of collaborative information-seeking as "tag team information-seeking," which involves people with a shared information need searching separately for information from external and internal sources, including people sources. In this "tag team information-seeking" approach, instructor group members, regardless of their subject area, sit down together to determine the problem, then they go out individually to look for information, based on individual expertise, knowledge and skills, doing a lot of research on their own, and then bringing back information to the group to make decisions collectively. As CD summarized, they "Go separately, then come back, discuss what the problem is, separate again, find information, come back together." JS described the same pattern in his group:

> So when we go to look for information, we go individually. And we bring information back together. We are together just at team meetings, then we'll break apart, we'll research information, bring it back again. It depends on what we are looking for really. One individual is pretty good at the Internet search so he does that [JS_3_17_2009].

Veinot pointed out that the distinction between the two forms is not rigid because some of the same people are engaged in both at different times, or move back and forth between these behaviors. These information-seeking activities may be loosely coordinated between people, if they are coordinated at all. Importantly, the activities are followed by participants sharing what they have found with their network members (Veinot, 2009, pp. 2318-2319). Studies found assigned or coordinated search approaches in workplaces (O'Day & Jeffries, 1993; Poltrock et al., 2003a, 2003b; Prekop, 2002; Twidale, Nichols, & Paice, 1997). In my study, larger groups of instructors are engaged in information-seeking using an approach that combines the two forms. RH illustrated the group's information activities:

> Sometimes, eleven people gather together in the same place, eat together, and discuss together, then we communicate because we are split out miles, a couple different parts of the country. Phone and email are the main ways for us to communicate. When we look

for information, we do it as a group. Two or three collectively go together, and we also individually get some information that we bring back to the group [RH_1_30_2009].

As discussed in previous sections, instructor group members intended to solve problems within the group (section 8.2.1) and employed a transactive memory system to access and use members' specialized knowledge during the instructional process (section 8.2.2). I added and named the third form of information-seeking as "intra-group information-seeking," which indicates that group members have shared needs, searching information within the group to reach consensus and retrieving group network-mediated sources of information, especially the transactive memory system to solve problems.

In practice, individual instructor participants use the approaches strategically, and in doing so, they apply the forms of "joint information-seeking," "tag team information-seeking," and "intra-group information-seeking," working within or between the modes, or applying them in combinations.

8.3 CONCLUSION

Field staff instructor groups are high performance groups since the tasks and situations are so complex. Crucial performance in many complex systems relies on the coordinated activity of individual team members. For example, cockpit crews, surgery teams and military teams operate in situations where ineffective performance can have catastrophic outcomes (Cannon-Bowers, Salas, & Converse, 1993). It is impossible for any single instructor group member to hold all of the knowledge required to ensure the success of fire service training. In such cases, instructor group members' knowledge and expertise has to be specialized and distributed. It is imperative that they coordinate since success depends on the knowledge and expertise of each member, as I discussed. Researchers have argued that team members hold unique expertise that they bring to bear in performing tasks (Orasanu & Salas, 1993). The study's findings reveal that instructor groups consist of individuals who have high levels of expertise in subject areas, requiring that information contributed from different group members converge in support of teaching, training and curriculum development. Fire service training turns out to be a compelling field for investigating how group network-mediated sources of information, especially transactive memory systems, serve as a critical informal source of information, how collaborative information-seeking and sharing develop and affect individual instructors' practices related to the instructional process.

The instructor participants' collaborative information sharing and seeking is often verbal, takes place in face-to-face situations or over long distances through the use of technology, and is highly task-specific and context-based. The shared and sharing aspects of group information processing are interdependent of each other (Hinsz, Tindale, & Vollrath, 1997). This study's findings suggest that group-level information-seeking and sharing is dependent on various aspects of individual- and group-level information-seeking and sharing. The study also suggests that individual-level information-seeking and sharing is affected by group-level information-seeking and sharing (see Levine, Resnick, & Higgins [1993] for their literature review of group- and individual-level information processing on group decision-making). Such interdependencies make it challenging to examine group-level and individual-level information-seeking and sharing separately and to trace their discrete influences. Members' roles might also affect both levels of information-seeking and sharing. The role of team leader as lead instructor in a group influences how discussion proceeds and how tasks of information-seeking and sharing are assigned and carried out.

Past research has done little to identify the role of a transactive memory system in information-seeking and sharing and the relationship between individual and group information-seeking and sharing. Overall, I conclude that adopting the transactive memory system concept can advance our understanding of how instructor groups seek and share information effectively in often dynamic and complex situations. This is particularly true in environments characterized by high stress, limited time and heavy workloads because such conditions require a high level of team coordination and a clearly defined distribution of each team members' domain of expertise to carry out tasks and achieve goals.

This chapter examines the group dimensions of the instructor participants' information-seeking and sharing behaviors. The information strategies that are developed by groups and the manner in which information is sought and shared are identified. By focusing my research on the perspective of individual instructor participants as members of groups, I attempt to enhance our understanding of the deeply interactive and socially embedded nature of instructors' information-seeking and sharing.

CHAPTER 9

EXPANSION OF LECKIE'S MODEL OF INFORMATION-SEEKING OF PROFESSIONALS

Building on the previous chapters, this chapter discusses the unique pattern of field staff instructors' information-seeking and sharing behaviors, focusing on reasons underlying the behaviors to expand Leckie's model of information-seeking of professionals.

9.1 PATTERNS OF FIELD STAFF INSTRUCTORS' INFORMATION-SEEKING AND SHARING

As I discussed in preceding chapters, seeking and sharing information can at times be a challenging undertaking. In many cases, the instructor participants are actively involved in the effort, working individually or with group members to identify the information that makes the most sense for them. Yet these information activities mark only the start of an unfolding and continual relationship between the individual instructor, the group(s) with which he or she is affiliated, and the instructional activities in which he or she is involved. Their information-seeking and sharing processes are typically closely associated with their work practices in instructional activities. This active and constructive process highlights the intersection of the instructor participants' institutional/formal, informal and group network-mediated sources of information, the core elements of their information-seeking and sharing processes.

9.1.1 Integration of Multiple Types of Information Sources

As I explained in the previous chapters, the instructor participants in this study draw upon a wide range of multiple types of information sources and engage in a variety of information activities as part of their dedicated efforts to teach, train and especially to develop curriculum, as seen in the three representative examples shown in Table 19. The multiple sources are listed in the order the interviewed instructors reported. See more details in Appendix R.

Table 19. Integration of Multiple Sources of Information in Sample Curriculum Development Projects

Fire Academy Program/Class	Multiple Sources
Command and General Staff/Homeland Security	. National Fire Academy (NFA)'s student manual . NFA PowerPoint . NFA curriculum . Experienced out-of-state NFA consultants . Experienced out-of-state NFA instructors and leaders from New York, California, Montana, Florida, Texas . Modification of the NFA curriculum . Local and state enhancements from personal experiences of different instructors . State Emergency Management Agency . Field operations guides for reference, from the Coast Guard and Mobil Oil company . Fire Scope's main reference material for incidents in the wildland . Personal experience: 60 classes and almost 35 years of being a firefighter . Learning from other instructors during classes . Library . Raw stories to help students relate . Hazards and Incident Management Team Conference . Internet . DVDs . Books . Articles, magazines . Video clips from Internet . Video from other classes . Clips from movies and TV shows . YouTube . NFPA manuals - standards . PowerPoint . Course evaluation . Instructor feedback
Firefighting	. Variety of reports on the Internet: firefighter death reports, NIOSH incident reports . Communication problems in a cockpit concerned with human errors . Books . Dissertation . Videotapes . Trade shows and journals . Fire magazines . DVDs . NFPA standards . People . Air Force instructors (outside fire service field) . Specialty (experiences and subject knowledge)

Table 19 (cont.)

Fire Academy Program/Class	Multiple Sources
	. Veteran users and local expertise (specific local techniques) . Professional conferences, e.g., FDIC . Aviation and pilot training . Crew research and literature . Medical resource management . Leadership management in high stress environments . Group decision making books . Personal library
LP (Liquefied Petroleum)	. Modification of previous programs . Expert (internal and external) . Manuals . National Propane Gas Association's lectures . National Transportation Safety Board . OSHA stuff . NFPA standards . Real world experiences for hands-on training . Experienced team instructors . Transactive memory system (3-person team) . Student feedback . Industrial magazines in the library . Industrial sites . Firefighting books . Fire Essential's magazines and books . Fire brigade . LP folder on shared drive: PowerPoint . E-mail . Videotapes on hazmat and petroleum based product, propane, propylene butane from Film Group, real incidents . Videos: Hazmat and fire investigation; sent-in tapes . Internet . Different websites: Minnesota and Indiana website . Shared drive . YouTube . Fire Investigation class . Incidents to help update curriculum . Books . Photos sent-in by other people . Calls to instructors . Big organizations, e.g., Boots and Coots . Library

The biggest challenge for instructor participants' using this wide variety of information is to "pull it all together," [MC_2_12_2009] "filter it down" [JD_2_5_2009] and "blend" both book knowledge and experiential knowledge [CAH_2_17_2009, JS_3_17_2009, TS_3_4_2009]. They always "look for resources" and search "lots of places" [LL_2_18_2009] for "as many sources as possible" [HG_3_2_2009], using "lots of sources to gather that information," and trying "to pull that all together, hoping that you are putting across the best information" [CD_3_5_2009]. They need "the ability to draw information from all those different programs that may not be packaged into specific programs" as necessary [WBM_2_10_2009].

MC illustrated an interesting example of an information integration process, finding "different ways" to "squeeze" (filter) information down to the "preferred" ways and back to show "other routes" in his LP training program:

> After we got students to understand the product, we had to look at how many ways that product comes to us. So we took all different ways coming to us from small cylinders to big trucks, and we built a small section on that. And we went all the way to how we handle it when those things come. Can we do anything about it? Can we handle with hose line in streams and be done within 15 and 20 minutes? Then we had to write one hour and a half program. We had to squeeze all that in to that aspect. Basically from there, then we went out doing hands-on. We took what we taught students in the lecture, the tactical stuff, we showed them setup, what was the preferred way to do this. Then we walked them through a couple of events the preferred way. We then basically broke down here what else they could do. We had other routes handling different events. So that's got us through the entire four hours basic blocks class [MC_2_12_2009].

Students come to the training as a "focus point to get that information" [JD_2_5_2009]. CD pointed out why doing research and using a variety of sources were important because instructors needed to validate the points they made to students:

> We take the NFPA and OSFM framework as objectives, we use [the] textbook[s] we use, really there is a wide range of sources come after that. You make [a] whole program

> probably based on people's experience, but you also want to have references, that you have gone out for research, that makes what you speak more valid points, because you took in your points and information from a different resource, so it is not only your own experience, but it is other people's experience too [CD_3_5_2009].

Some instructor participants start to search for information on the Internet, others start with a network of people, personal experience, a personal collection, library, or group members. Even though it is in the same subject area, the path to acquiring information to meet dynamic needs, regardless of whether it is urgent or not, is not exactly the same. The instructor participants are often confident that "there are so many avenues" they can go through, and sources of information "are always there" that they can access and employ.

In the fire service, even though there are SOPs (Standard Operating Procedures) or SOGs (Standard Operating Guidelines) that address about anything instructors can think of, the instructor participants admit that they do not always know the answer sometimes, but they know where to get it. Knowing where and from whom to get it is as important as knowing the answer. For example, CAH pointed out that he lacked information on hazardous materials emergencies. So if he was on the scene for a hazardous materials emergency, he would surround himself with hazardous materials people. "My job is to get them the resources they need, in order to fix the problems. Knowing who to go to is as important as the answer to the problems" [CAH_2_17_2009]. CAH's network of people helps him get what he wants.

It is worth noticing that the instructor participants access and use knowledge from outside their core subject areas. The information strategy is called "crossover." The instructor participants look for new people, new help, new sources, new research data and new courses. Some of them find out if something is similar and closely relevant in other fields, e.g., military, aviation, industry, medicine, neurolinguistics, family counseling, etc. They often start with fire literature but go on to other literature and "research in." They try to cross over and ask if they can use the information obtained from crossover. They "steal information from anybody." They would "talk to experts who have been working in that field, interview people, go right with them, talk to them, spend hours in their shoes and pick their brain." As JWR described:

> We have a bunch of Air Force instructors coming down, and they have new ways of doing something so we always look outside. I always crossover and look at communication problems in a cockpit that could deal with problems and errors, human errors. We have samples of research data when there is too much going on, pilots can't remember everything. He can only remember five to six items. I did a lot of teaching, cross training in aviation, so a lot of stuff on pilot training. I go deep into aviation, CRM [crew resource management] literature, medical resource management literature, and I deal with leadership management in high stress environments. I used so much aviation because there are lots of things in aviation I can use in the teaching principles for some of the lessons I learned [JWR_2_25_2009].

Like several other instructor participants who found similarities and relevance between fire service and military experience, EE used his military experience and examples to relate to fire service experience in his teaching with his co-instructor. As he put it:

> In our teaching, MM and I relate our military experience with that fire experience. We talk about the battleground to the fireground, the trust of each other, you know your legacy and traditions, you know the dedication, the trust, and how close it is the military to the fire service, and the value. If we are doing something in leadership, there are times I may look into some military history or military examples of leadership, the value of it,

> the image of leadership. I have military books that I will reference. I will go to military reunions and meet friends that I served with. So I try to relate to the history part and bring it to today. That's basically where a lot of my thoughts and feelings and things come from [EE_2_25_2009].

The instructor participants' cross-subject searching helps support important information gathering and expands their point of view. Some instructor participants maintain multiple knowledge bases. They develop their core knowledge base more extensively than others. They need more constant work to stay current and explore new knowledge. In the concluding chapter, I will apply what we have learned about crossover practices to make suggestions for information organization, service and collection development to facilitate crossover information gathering and learning.

Many different types of sources of information are needed, sought and used in the process of instructional activities, all of which are tied closely to the individual instructor participants' subject interests and their surrounding personal and group environments. Information comes in different forms and from different sources. As is apparent from the stories of the instructor participants in this study, the integration of multiple sources of information is an active, constructive process characterized by the instructors' ongoing learning and searching for new and better ways to meet their dynamic information needs.

As I discussed in the previous chapter, Lloyd (2007) created three modalities for the knowledge domain of Australian Firefighters as textual, corporeal, and social sites (see Table 2). Lloyd examined how Australian firefighters used multiple sources of information in the three sites for their career development. Lloyd concluded that information from the three sites "contributes to the situated knowledge through which the discourse of the firefighting profession and practice is rendered" (p. 197). In the United States, firefighters are required to focus their learning on the three domain areas of knowledge (cognitive), skills (psychomotor) and affective (attitude) (KSA) as shown in Table 1, which are similar to Lloyd's three sites. In the preceding chapters, I demonstrated that instructor participants sought, used and shared formal/institutional, informal/personal and group network-mediated sources of information to support learning in the three domain areas. I conclude that the learning in the three domain areas of the KSA knowledge structures defines the boundaries of information sources and dictates multiple types of sources that are needed and used by instructor participants. I summarize fire service knowledge structures with an information dimension in Table 20.

Table 20. Fire Service Knowledge Structures of KSA with an Information Dimension

US Fire Training - KSA Classifications	**Cognitive Domain (Knowledge)** "Know Why" Knowledge	**Psychomotor Domain (Skills)** "Know How" Knowledge	**Affective Domain (Affective)** "Know Who" Knowledge
Ruan (Fire Service Training in USA)	. Formal and Institutional Sources of Information, such as in print and media formats, from the library and digital sources from the Internet	. Informal and Personal Sources of Information, such as street experience and personal collections . Group Network-Mediated Sources of Information, such as transactive memory system	. Informal and Personal Sources of Information, such as social networks of people . Group Network-Mediated Sources of Information, such as transactive memory system
Lloyd (Fire Service Training in Australia)	Textual Site	Corporeal Site	Social Site
Lloyd (Fire Service Training in Australia)	. Codified knowledge and institutional discourse, such as print and digital sources	. Body as source of sensory information	. Collective discourse of the community practice . Firefighter's social relationships

It has often been accepted that information needs and information-seeking processes depend on workers' tasks (Belkin, Oddy, & Brooks, 1982; Ingwersen 1992; Leckie, Pettigrew, & Sylvain, 1996; Mick, Lindsey, & Callahan, 1980) and the instructor participants carry out complicated tasks, as shown in Table 9. Empirical studies have examined the relationships of information-seeking and task characteristics, and consistently concluded that increased task complexity leads to a greater use of multiple sources (Alwis, Majid, & Chaudhry, 2006; Anderson et al., 2001; Ashford, 1986; Byström, 2002; Byström & Järvelin, 1995; Katz & Tushman, 1979; Kuhlthau, 1993a; O'Reilly, 1982; Tiamiyu, 1992; Tushman, 1978; Vakkari & Kuokkanen, 1997), regardless of the type of source (e.g., Culnan, 1983), as illustrated by the instructor participants. The literature often addressed two task characteristics, which are task uncertainty and task complexity (Bin, 2009). Task uncertainty indicates a lack of predictability, structure and information concerning the problem being presented (Anderson et al., 2001). Task complexity suggests the extent to which a person or unit must coordinate and collaborate to solve a problem with others (Byström, 2002; Byström & Järvelin, 1995; Tushman, 1978), as the instructor participants' group work demonstrated in the preceding chapter. Bin (2009) argued that the use of different information sources would vary depending upon the level of complexity and the uncertainty of the activity for which information is required. Task complexity has a direct relationship to source use, as Byström (2002) found. My study's findings are consistent with those claims that the extent of instructor participants' use of multiple types of information sources reflects their task complexity and uncertainty, which I will discuss while examining instructor participants' view and theory of work in a later section.

9.1.2 Field Staff Instructors' Information Process and Practices

The instructor participants in this study have diverse subject expertise and rich experience backgrounds, as I demonstrated. While they are engaged in complex information activities and develop the strategies to facilitate the instructional process, the pattern for their information process and practices can be clearly identified as shown in Table 21. The analytical approach was adopted from Palmer's (1996) analytical approach used to discuss information practices of interdisciplinary scientists.

Table 21. Field Staff Instructors' Information Process and Practices

Process	**Practices**
Seeking	. Doing research . Joint, tag team, and intra-group information-seeking
Gathering	. Doing research . Keeping current through reading . Probing through learning . Accumulating experience on the street . Networking with people both internally and externally . Crossing over core subject area
Sharing	. Passing on . Storytelling of lessons learned . Accessing transactive memory system of individual members' expertise . Discussing . Decision making
Integrating	. Doing research . Pulling multiple sources together . Filtering . Synthesizing
Presenting	. Writing curriculum - Mirroring - Tweaking - Rewriting - Updating . Teaching - Sharing lessons learned - Storytelling . Training - Demonstrating show-and-tell

I divided the instructor participants' information process into five categories: seeking, gathering, sharing, integrating and presenting along with their information practices. Similar sequences were found in Ellis's search model of information-seeking behavior of social scientists (Ellis, 1989) and academic physicists and chemists (Ellis, Cox, & Hall, 1993). Elllis' model described six characteristics of social scientists' information-seeking patterns as starting, chaining, browsing, differentiating, monitoring and extracting, and eight characteristics of seeking patterns in physicists as starting, chaining, browsing, differentiating, monitoring, extracting, verifying and ending. Except chaining, which is following chains of citations, I noted parallel activities between Ellis' and my categories.

Information "seeking" is a hunting effort performed by the instructor participants either individually or collaboratively in a group with shared needs, or both, targeted at finding out specific pieces of information. It can be simple and direct by asking a colleague or friend, but it can get complicated by going beyond instructor participants' core subject areas, as the instructor participants tend to look in many places. Continuing to look for information is a major information-seeking activity of the instructor participants. The searching can be stubborn, difficult and endless, as CAH described his constant and ongoing search:

> I typically have no trouble finding information. Of course, the area I teach in, I am usually looking. I mean 24 hours a day and seven days a week, I'm looking for information on stuff. For me, a course, it may take two years to build it after I got the idea. It took me two years to actually get to where it is a viable course because I spent two years to look for information [CAH_2_17_2009].

Information "gathering" is a loose effort with an emphasis on problems and needs and involves multiple dimensions of proactive activities. The instructor participants gather when they "do research" on topics individually or collaboratively, and doing research is a major information gathering activity. Research often comes into play at the start of the instructional process and continues its role throughout. The instructor participants are required to stay current on the literature and in the operational field to understand the complete context of what's going on in their area of interest. Reading and meetings, especially face-to-face meetings, are their primary means for staying current. Keeping up with information in the primary subject area demands maintaining awareness of dynamic fire emergency situations, the different responses and emerging solutions to the problems. There are other key practices involved in gathering, as I discussed in previous chapters, through the library, the Internet, networks of people and groups. When the need for relevant information is satisfied, the instructor participants may shift from the gathering focus to different directions. The instructor participants are concerned about the difficulties they encounter seeking and gathering information, such as the quality of online searches and information overload, and they learn to form a number of strategies to cope with these challenges.

The instructor participants' information "sharing" at the individual level is constant and conscious as they passionately "pass on" knowledge and experience to other instructors and students. The instructor participants' information "sharing" in groups is imperative and effective when they retrieve and employ group network-mediated sources of information, in particular transactive memory systems, discuss and make decisions collectively, and facilitate sharing and exchanging among group members.

Information "integrating" is no doubt considered to be especially useful. The instructor participants seek sources of information that help them integrate across formats, organizations and subject areas. The study's findings raise an important point that the integration of multiple sources can in themselves also become sources of essential information that the instructor participants employ to guide the management of their information behaviors.

Information "presenting" is the outcome of the information process and practices, when information is passed on to other instructors and students. As one instructor indicated, one of the things he was always mindful of was to "give good information to get the point across differently" [JL_2_23_2009].

Overall, the five categories in the process are interwoven and ongoing. The process of instructor participants' seeking, gathering, sharing, integrating and presenting information is also performed by groups, as I discussed in the preceding chapter.

9.1.3 Attributes of Field Staff Instructors as Information Seekers

Strong evidence in this study's data demonstrates that the instructor participants are savvy, active and determined information seekers. Table 22 presents the attributes across cases, linking them to the information process along with sample quotations. The analysis is based on the comprehensive style of their information behaviors as well as specific approaches to problems. The characteristics come from the instructor participants' serious attitudes that support the breadth and depth of their subject interests and every effort for practical synthesis of the information they have obtained to solve problems.

Table 22. Attributes of Field Staff Instructors as Information Seekers

Attribute	**Information Process**	**Sample Quotation**
Digging	**. Seeking**	When we look at ourselves as fire service, we always say never be satisfied; never think that you should know everything about this job. You have to keep learning. You have to keep digging for information, everything you possibly can about this job, whether you have two years on or 35 years on [LL_2_18_2009].
Being Open-minded	**. Seeking** **. Gathering**	Keep an open mind because information will come from a lot of places that you don't realize. Don't limit yourself one specific way [LD_2_17_2009].

Table 22 (cont.)

Attribute	Information Process	Sample Quotation
Doing Research	**.Seeking** **. Gathering**	I have done the research. Prior to that course I would go to a library and search the books and magazines. Now the Internet does make it a little bit easier. I do try and research for as many sources as possible, to actually get the latest and most accurate information [HG_3_2_2009].
Reading	**. Seeking** **. Gathering**	I stayed very full with the information on constantly reading. I read prescribed textbooks, and looking at the course syllabi for the various courses I worked with the program directors, for all those specific programs to make sure we've got objectives up to date with the NFPA standards [WBM_2_10_2009].
Observing	**. Seeking** **. Gathering**	Go and look what has been developed, what we have. The big thing is if you get in, start to go around [JRs_2_18_2009].
Lifelong Learning	**. Seeking** **. Gathering** **. Sharing**	My thoughts are always about learning in this business. It's great to learn one way or the best way that does something. So even though you have the best way, you always have the second, third, fourth, in case the best one does not work [CD_3_5_2009]. You never stop. No. You can never have enough information. You go through life everyday and you learn something new [JS_3_17_2009].
Lifetime Collecting	**. Gathering**	I save everything [SD_1_27_2009].
Compiling	**. Integrating**	In the beginning I had so much information because as I started to dig in, I had to really pare the information down. I can boil it down, condense it, really simplify it so I can apply and students can understand it [WBM_2_10_2009].
Sharing	**. Sharing** **. Presenting**	In the fire service, there is a passion in the instructors to continue to pass on so the sharing culture is very dominant. The culture really wants the next guy coming in to know from our mistakes. We want students to do a good job and go home safe [GG_3_10_2009].

As I discussed in Chapter 2, continuing education and research requirements are two of field staff instructor hiring requirements at the Fire Academy and reflect a strong fire service training culture, which emphasizes the ability to do research and lifelong learning. Every instructor participant talked about "doing research" passionately. To instructor participants, the notion of "doing research" means searching, looking and integrating ("pulling") multiple types of information sources, and they describe their persistent, sometimes adamant searching for pertinent information on various topics they are working on. There are lots of resources tied into research, and they have to get it done to support what they feel is important to cover in the curriculum, class lectures and skill stations.

As lifelong learners and lifetime collectors, although the instructor participants are experienced and knowledgeable, “they are always looking for increasing their knowledge. They work every day and try to find something new or increase that knowledge base. They never stop.” CD believed that “instructors take a step above and always search for new information and new experiences. And they are also people that are out on the street, seeing those things on a day-to-day basis” [CD_3_5_2009]. In explaining how they go about finding ways to incorporate information into daily work practice, the instructor participants often used expressions like “lifelong learning” and “student of fire service.” In these cases, learning refers to a gradual accumulation of experience, education, and knowledge, along with their lifelong passion for learning. Across the instructor participants, they reported that fire service instructors have always “looked for a way, a better way, a more perfect way to manage the incidents” [BF_3_11_2009] and “the best practices” to solve the problems, which is reflected in their information-seeking and sharing behaviors. They “always do research on it all the time” and are “always looking for new stuff” to make teaching, training and curriculum development better. They never stop searching, sharing and learning. “That is the fire service training culture” [JD_2_5_2009].

However, the instructor participants found compiling, paring down and integrating information to be one of the most challenging issues, as JWR described:

> I am an information junkie, so I will find the information. I mean I have been given tools of the library and through the library that I would get too much information. I will gather

> too much and read too much, and my hardest part is boiling it down into what we are going to do out of all the stuff and what we are going to focus on. It is that narrowing down, focusing on what I want to accomplish. That is the hardest [JWR_2_25_2009].

To counter "the terrible attitude of adding and adding and adding and adding," RAV evaluated the information and made sure it had relevance and importance so he could share it with students. He continued,

> When I stop searching for new information, it is usually when the timeline says I need to get this up and run it. That goes along with any program that you develop. You are always evaluating it, so I probably never ever stop. You add content, you re-evaluate and you add content as you see necessary to either improve the program or cover a point that you may have missed [RAV_3_10_2009].

For many instructor participants, digging, being open-minded, doing research, reading, observing, learning, collecting, compiling and sharing are significant parts of the instructional process, and the intention and desire behind the information activities primarily lie in the nature of dynamics and the uncertainty of fire service business. Information is always sought with a clear purpose to support what is already known and/or unknown, and information that is collected may result in new ways and options of doing the work. The instructor participants often have the explicit goal of information-seeking and sharing, as when they explore multiple types of sources of information to expand their knowledge base and enhance their work in order to train their students appropriately and keep them safe during emergency responses. The instructor participants' information practices and combinations of activities are well suited to their pursuit of information.

9.1.4 Field Staff Instructors' View and Theory of Work

All instructor participants stated uniformly that the fire service is a dynamic, dangerous and serious business. Every day is a challenge since things change rapidly [EE_2_25_2009]. No two fires are the same [RSS_2_19_2009], like "snowflakes" as described by TS. There is no way to know everything [TS_3_4_2009]. If firefighters make mistakes, people die, and sometimes firefighters pay with their own lives [MM_2_26_2009]. It's brutally about life and death. Firefighters usually experience high levels of uncertainty in their work environment and have to make decisions in a very short period of time during emergency responses. Several instructor participants disclosed their "fear" of fire and "moment of terror:"

> Fire scares the death out of me. Any good fireman is going to tell you the same thing. They have a healthy respect and fear for fire. If you are not afraid of it, you are wacked. You are going to get somebody killed. That is how it is [LL_2_18_2009].

CD shared his thoughts on fear of an "unknown situation" when first responders handled hazardous material products at the emergency scene:

> Once you do this long enough, you realize certain products you run into all the time: anhydrous ammonia, natural gas, chlorine. You became familiar with those products. But when you see something you are not familiar with, that is when that fear starts to kick in. You do get inherently worried. What's happening next? The situation may change [CD_3_5_2009].

EE found that teamwork and trust with experienced people would help overcome fear [EE_2_25_2009]. When experienced instructors teach students, they ask students to trust what they are talking about, and students had better believe in them, because when students get into firefighting, they have to trust one another.

Because of the dynamic nature of the fire service business that is reflected in fire service training, the instructor participants pointed out that they had to constantly rewrite, update and revise curriculum as RP illustrated how frequently his program's curriculum had to make changes to accommodate new standards and requirements:

> Hazmat has been in existence for over 20 years, but often depending upon whether it is an OSHA development or an NFPA development or the Fire Marshal development, the curriculum has to be updated. There's a book called *Emergency Response Guide* [ERG]. Every four years, that book comes out. Well, every four years, we have to twist at least the awareness level of hazmat training because it is based largely on that book. If you look back to the first ERG, that was in 1980. It was probably 60 or 70 pages. Now it's over 350 with 10 times the amount of chemicals, so you can see why it's a very dynamic business. None of our curriculum is static [RP_2_19_2009].

The instructor participants are clearly aware of the changing world environment, and everything else changes around it. "You got to stay up with the times, you got to grab what you can from anybody and everybody, just see how you improve something" [MC_2_12_2009]. The instructor participants want to operate with the best material, the best information that they have in hand, but at the same time they realized that they can't use the same term to determine every fire because they just do not know everything about every fire every time [EB_3_10_2009]. Uncertainty and the dynamic nature of the fire service make instructors' task complexity even more complex and challenging to carry out.

During the interviews, I asked several instructor participants to make a comparison between them and engineers. This question was not included in my original interview guide, and it emerged from some interviews. They recognized the time frame that engineers have to solve problems is completely different from the time frame firefighters have to solve problems [MM_2_26_2009]. LL further explained the differences between fire service instructors and engineers, and why fire service instructors have a different pattern of information behaviors due to "a job unknown":

> An engineer does not run a risk of getting himself killed, or other engineers, around him when he goes to work that day. When firefighters go to work every day, they make a poor decision, they do something stupid, people die, either yourself, members around you from your department, or your company, or your co-workers, or somebody on the street you try to respond to help. That's the difference between us and engineers. Engineer says, "Hi, I solved my problems. It's done. I need to know everything about this particular issue." With us, we don't ever have just that particular issue. It's a whole bunch of stuff. We are constantly looking for information to improve ourselves, improve our fire service, and improve what we do, that's the mindset, personality of firefighter. You cannot think you know everything. There is no routine fire. Every fire I've been to is different. Every one! [LL_2_18_2009].

Therefore, all instructor participants emphasized the clear objective for their instruction was always to ensure firefighters' safety, and they strived to share impact points that would make individual firefighters' careers as safe as they could be. A senior instructor participant described his drive and desire to protect the safety of young firefighters through training:

> So we have to learn as much as we possibly can and share that with other people. And the worst day you'll ever have in this business is when you bury one of your firemen. The second worst day is when you bust your butt to make the rescue, and it just doesn't come out right at all. And we all second-guess what if, what could I have done better, what

> should I have done, you know, everything else. That is kind of what drives you. So if I could do anything for you as a young firefighter, the most important thing I can do is try to save you from having to go through some of the grief that I have gone through [MM_2_26_2009].

Uncertainty has an obvious impact on the instructor participants' information behaviors. All instructor participants indicated that they did not think that they knew everything about the fire service business, and that's why they emphasized they were students of the business. Radecki and Jaccard (1995) suggested that individuals who believe that they are already knowledgeable about a topic area will be less likely to search out additional information about that topic (p. 114). It is no surprise that the instructor participants make every proactive effort to help students reduce their uncertainty through rigorous training with information they find. They strive to integrate multiple types of sources of information so students can be ready for tasks, perform their work effectively and go home safely. The instructor participants' heightened sense of uncertainty guides them to be conscious of values and behaviors to be learned and to often consider what they do not know and how to obtain the information they desire. As a result, they seek information in a highly deliberate and clearly conscious manner, as I demonstrated and discussed in the preceding chapters. They are likely to seek information with an elevated sense of awareness or mindfulness and are "always trying to find something better and to make that happen." They view seeking material as just a natural progression that makes it happen [HG_3_2_2009] because instructors desire to prepare students and make them battle ready mentally and physically. Miller and Jablin (1991) claimed that information-seeking could be a useful strategy for individuals dealing with uncertain environments. One of the important ways in which the instructor participants can reduce their level of uncertainty is by seeking out and sharing information -- information about role expectations, about their work practices, issues and solutions, their performance, teamwork and organizational issues -- and they are fairly strategic in the process.

Uncertainty is considered a fundamental catalyst for instructor participants' information-seeking and sharing behavior. My study findings confirm Berger and Calabrese's (1975) conclusion that "high levels of uncertainty cause increases in information-seeking behavior. As uncertainty levels decline, information-seeking behavior decreases" (Berger and Calabrese, 1975, p. 103). My findings reveal how the instructor participants reduce uncertainty primarily through interacting with multiple types of sources of information and finding multiple ways and options of doing business. As such, their information-seeking and sharing efforts are likely to be focused more on the quality and integration of information as I discussed earlier, covering as large a variety of information as possible. The dedicated effort in which the instructor participants seek and share information is likely to be shaped by their level of expertise, experience, subject interest, understanding of the business, networks of people, groups with which they are affiliated and personality and contextual factors associated with individual work settings. The instructor participants demonstrated a strong and impressive capability to utilize a variety of information-seeking and sharing tactics to obtain pertinent information.

As I discussed in Chapter 2, the fire service and the Fire Academy stress psychomotor domain learning with hands-on skills training and experience-based knowledge. The RPD model, especially automatic RPD, has been treated as an ideal mindset and goal of the instructional activities when fire service instructors train firefighters in response to emergencies. RPD (recognition-primed decision) involves non-optimizing and non-compensatory strategies and requires little conscious deliberation. Firefighters are trained to obtain the critical cues for handling a specific incident type to reach these “recognitional” matches and cues in emergency responses. Across the sample, the instructor participants offered their own explanations regarding their viewpoints and theories of work, based on the nature of the fire service business, which ties closely to the RPD model. They explained to me how they interpreted and understood RPD. The variations in their conceptualizations are shown in Table 23 (see more details in Appendix S). Some said they had heard about RPD, others said they had not, but indeed they applied RPD principles to their work practice.

Table 23. RPD Model in Field Staff Instructors’ Own Words and Concepts

Program	**Instructor’s Word**	**Concept**	**Heard about RPD (Y/N)**
Emergency Medical Service	When you teach EMT-B class, when you have them first assess the patient, you want them to start airway. You have to do airway first… Assessment, Airway, Breathing, Circulation. We want them to get that *habit* [SD_1_27_2009].	. Habit	N
Firefighting	That [RPD model] is how firemen pretty much act. That’s why we do so much training, and training is so over repetitive that you do it over, and over, and over again because it has to be second nature like tying your shoes. There is where the experience comes in, where I have been in a fire before. I know exactly how this is, what could happen so you run as pre-plan in your head [JS_3_17_2009].	. Repetition . Second nature . Experience . Preplan	Y
Hazmat	You don't know what happened until it has really happened. I consciously think of like that…We don’t know what would happen. But if I have done this enough times, or somebody has told me, I have read about it, I have seen it, or I have heard it, all those experiences came at that moment. You have been in the circumstances enough times. You just know [RP_2_19_2009].	. Experience	Y

Table 23. (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Technical Rescue	There are three strategic criteria – the life safety, the incident stabilization, the property conservation and preservation. There [is] so much information going on, but again that's all come from your automatic response, being trained, being able to recognize those things, but trying to get as much information as you can, as quickly as you can. But for the most part, you have to go trial and choose, using your experience, knowledge, training and education, make as good decisions as you can make with little information you can have [WBM_2_10_2009].	. Three strategic criteria . Experience . Training	N
Unified Command System	Yes, I think somewhat you can [use RPD] because that all ties back to experience and training [LD_2_17_2009].	. Experience . Training	Y

The RPD model and its concepts help instructors manage uncertainty in the instructional process and ensure they achieve their instructional goals. As one instructor participant pointed out, "instructors who do not use the RPD model are always behind. They always question themselves. They are looking back for information maybe from a book. They have not gained experience to consult a particular knowledge base to say they are on the same page to make that quick decision" [MM_2_26_2009]. Cases shown in Table 23 and Appendix S support and emphasize the critical role of the RPM model as a driving force behind fire service training. It deeply reflects fire instructors' fundamental views of work, as RL summarized: "You make this decision because you know the results. It's because our training [that] has been done catered to that model" [RL_2_11_2009]. The study's findings confirm the important role of the RPD model in fire service training and provide evidence of its critical influence that leads instructors toward a heavy reliance on experiential knowledge from street experience, social networks of people and group members' knowledge, as I discussed in the preceding chapters.

The instructor participants always claimed firefighter as their professional identities, regardless of their ranks. Like many instructor participants, EE said, "I was a firefighter, I am a firefighter, I will always be a firefighter" [EE_2_25_2009]. Every field staff instructor received basic firefighting training and became a firefighter, as shown in Figure 3. They continued their training and developed their own specializations during their career development to become an instructor in the Firefighting, Hazmat, Technical Rescue or Fire Investigation programs (The Fire Academy Director, personal communication, August 30, 2010). Firefighter is the professional identity and the lens through which all instructor participants view their work and form the theory of their work. Among the Fire Academy's specialized training programs, Firefighting is the biggest program, and most instructor participants I interviewed are from that program. Hazmat, Technical Rescue and EMT programs demonstrate more similarities than differences with the Firefighting program; however, the Fire Investigation Program shows some fundamental differences in the area of instant decision-making. To fill this role of fire investigator, firefighters have to learn to shift out of the RPD model so as not to act too quickly, rather taking time to address the legal issues involved. Scientific findings are more critical in the Fire Investigation Program than experience-based knowledge [EB_3_10_2009].

I provide strong evidence to demonstrate the uniqueness of the fire service field staff instructors' information-seeking and sharing behaviors. Now it is time to review the Leckie model of information-seeking of professionals to see how it applies to the fire service setting and to determine what enhancements are needed.

9.2 EXPANSION OF LECKIE'S MODEL OF INFORMATION-SEEKING OF PROFESSIONALS

My study's findings report that the instructor participants' professional work is reflected in more than the five roles Leckie, Pettigrew, and Sylvain (1996) identified for other professional groups, and they perform complicated tasks during the instructional process. My findings endorse Leckie, Pettigrew, and Sylvain's suggestion that information needs and the information-seeking process depend on the seeker's roles and tasks. My findings also support their claim that information needs arise from an "awareness of information" and motivate a person to examine the "source of information." The key variables they outline that are applicable to this study include the familiarity (e.g., informal sources of information and personal collections) and prior success with the source (e.g., search strategies the instructor participants employed), the trustworthiness (e.g., expert source), quality (e.g., expert source), timeliness and accessibility of the sources (e.g., informal sources of information and personal collections).

In Leckie's model, information-seeking behavior is described as a two-way arrow between "characteristics of information needs" and "outcomes," called "information is sought." The seeking process starts from the top with "work roles" and complicated "tasks," which are embedded within the roles. The end results of information-seeking, named "outcomes," influence other components of the model through two "feedback loops," which are not part of the six components, to "source of information," "awareness of information" and "information is sought." It is noted that the flow of the Leckie model is linear and a top down process. As shown in Figure 9b (presented earlier as Figure 1), Leckie's model has six components linked by one-directional arrows, except "outcomes" and "characteristics of information needs" affect each other and are shown to be bi-directional. The model is explicitly targeting work-related processes, but it is partially applicable to fire service field staff instructors' information-seeking (not sharing) with limitations and over-simplifications. My motivation to revise and expand Leckie's model is to accurately reflect fire service field staff instructors' information behaviors that are embedded in their work context and practices.

The results of this study point to ways that the model can be usefully expanded and modified, shown in Figure 9a below with the expansion parts. Compared to Leckie's model as shown in Figure 9b, my expanded model includes the additional components of "personal characteristics," "professional work," "professional knowledge," and "feedback," the four big arrows around the model, arrows for "source of information" and "awareness of information" pointing back to the component of "characteristics of information needs," and "information is sought" contains both levels of "information is sought individually" and "information is sought collaboratively."

The personal characteristics of the information seeker are not considered by Leckie, Pettigrew, and Sylvain (1996) to be one of the elements determining the "characteristics of information needs," although it was acknowledged as an "intervening variable" by Leckie and Pettigrew (1997, p. 102). Drawing from interview data, the instructor participants' personal characteristics include interests in TV channels, personal hobbies, personal emotional pain and frustration from the loss of loved ones and more. I identify and include them in the expanded model as one of the direct factors determining "information needs," as I discussed in Chapter 5.

Figure 9a. Model of Information-Seeking and Sharing of Fire Service Field Staff Instructors

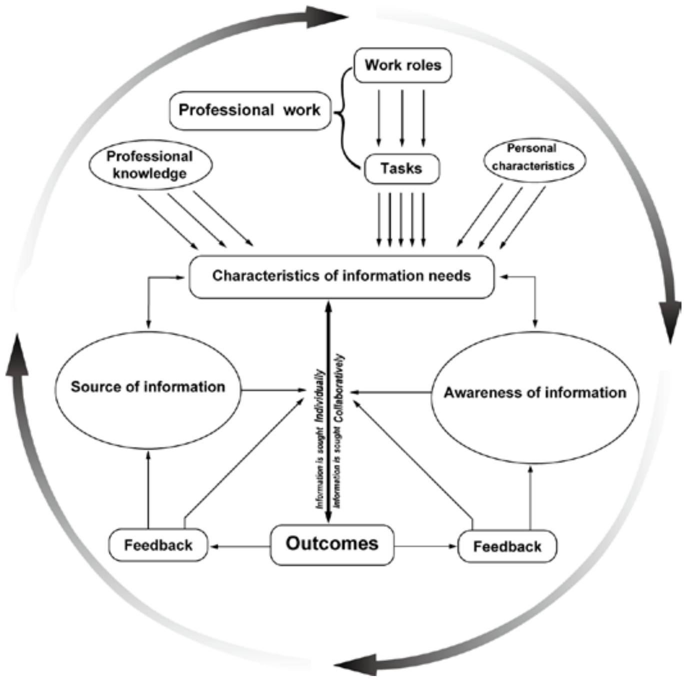
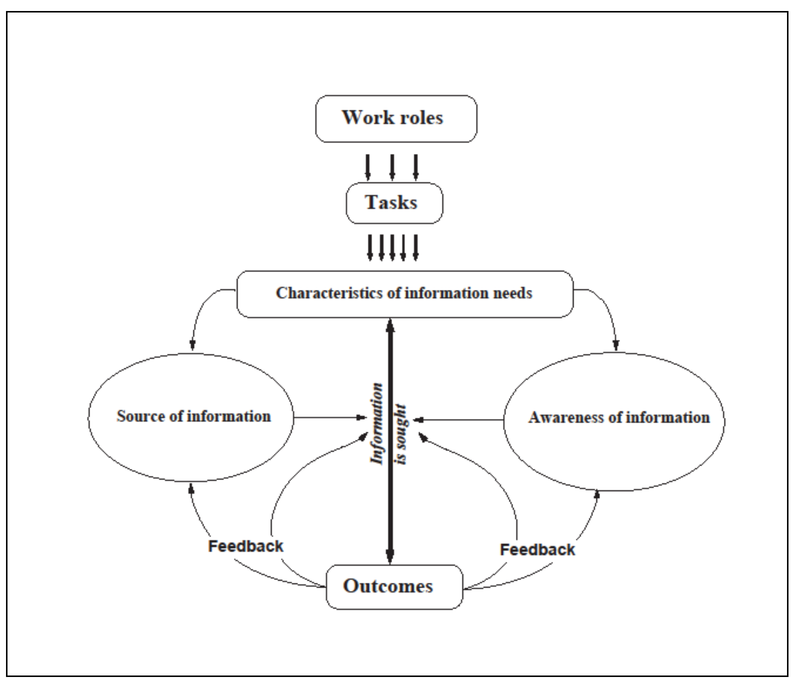


Figure 9b. Leckie's Model of Information-Seeking of Professionals (Leckie, Pettigrew, & Sylvain, 1996, p. 180)



Leckie, Pettigrew, and Sylvain did not explicitly tie roles and tasks with professional work (see my review on professional work in Chapter 3). The component of characteristics of information needs in Leckie's model includes a number of intervening variables/factors that influence or shape the information needs of professionals. Leckie, Pettigrew, and Sylvain (1996) outlined these factors as demographics, context, frequency, predictability, importance and complexity. They also pointed out that studies about the information-seeking of professionals indicated that the nature of the specific profession could influence the formulation of the information need (Leckie, Pettigrew, & Sylvain, 1996, p. 183). However, they did not sufficiently develop "professional knowledge" as a factor in their discussion of other professions. My study's findings indicate that fire service professional knowledge, i.e., fire service knowledge structures of KSA -- (Knowledge [cognitive], Skills [psychomotor] and Affective [attitude]) -- is a critical factor that influences the changing needs of fire service field staff instructors. Professional knowledge structures delineate the boundary of "source of information" in the three domain areas of learning in which firefighters are required to train, dictate multiple types of information sources that are used by the instructor participants and impact the instructor participants' information-seeking processes. Researchers concluded that professional knowledge underpinned and governed individuals' performances in a profession, and individuals used it to interpret and understand their work (Cranefield & Yoong, 2009). Thus, I conclude that professional knowledge must be explicitly considered as a crucial factor under the component of "characteristics of information needs" in the expanded model.

Like other information-seeking models, Leckie's model failed to capture "information sharing." From my study's findings, I manifest that "information sharing" exists in the "source of information" and "awareness of information" in the form of group knowledge of individual expertise as a transactive memory system and in social networks of people. Information sharing is also present in “information is sought” when searching for information is done collaboratively, in the form of joint, tag team, and intra-group collaborative information-seeking. The information integration occurs right at the converging intersection of “source of information,” “awareness of information,” and “feedback” that effectively contribute to the information-seeking process.

Leckie, Pettigrew, and Sylvain (1996) never defined “feedback” as one of the components of the model; rather they are just “loops” that are generated by “outcomes” to start the next round of the search. My study’s findings determine that feedback is one type of information source that influences “awareness of information” and “source of information” that prompt information needs. Thus feedback is indicated as one of the formal components in the expanded model. I also add two-way arrows between “characteristics of information needs” and “source of information,” and “characteristics of information needs” and “awareness of information” to show the two-way flow of information and interactive dynamics.

The instructor participants’ stories in this study highlight their information-seeking and sharing processes as “continual,” “non-stop” and “never satisfied” experiences, perhaps characterized more by the dynamic, dangerous and unpredictable nature of the fire service business and the instructor participants’ intense desire to deal with uncertainty, overcome fear, and ensure the safety of firefighters than by anything else. The instructor participants’ task complexity in the course of teaching, training and curriculum development is also a catalyst for their information-seeking and sharing behaviors, and it motivates them to seek the best piece of information to ensure safety during training and emergency responses. Furthermore, multiple types of sources of information are constantly integrated to meet the instructor participants’ changing needs. I add four arrows around the model to demonstrate the cyclical and interactive process (see Figure 9). The processes are interrelated within the process of information-seeking, sharing and use. My attempt to deal with all elements simultaneously and to pay systematic attention to the role of the individual and group in analyzing information-seeking and sharing behaviors as a whole and as an ongoing process is believed to be distinctive and novel.

By taking into account the findings from this empirical study, my expanded model outlined in Figure 9a highlights the two levels of individual and collaborative information-seeking that have been shown to affect information-seeking and sharing behaviors of fire service field staff instructors and outcomes associated with these behaviors. As well, it highlights the importance of recognizing the unfolding process of information-seeking over time. It provides a more complete picture and better framework for information-seeking and sharing of fire service field staff instructors. It confirms that the different characteristics of various work environments make one type of information-seeking different from the other (Tackie & Adams, 2007). My study's findings disagree with what Leckie, Pettigrew, and Sylvain (1996) argued that information-seeking and information related practices were more similar across diverse professions than previously had been thought. My study's results align with Herner's (1954) user study that specifically concerned "differences" in information-seeking habits and practices (Pinelli, 1991).

For decades, LIS information behavior researchers have focused on individual information-seeking, as seen in the review in Chapter 3. Although there is some research on collaborative information-seeking, few studies recognize the importance of group knowledge (transactive memory system) in the information-seeking process. Few researchers investigated individual and collaborative information-seeking and sharing concurrently.

9.3 CONCLUSION

I identified the patterns of information-seeking and sharing of the instructors in this chapter, which displayed some significant and salient characteristics. The uncertainty and complexity of the fire service business strongly requires the instructor participants to search for information in a timely fashion, so it can be used to manage uncertainty. The search is often filled with a compelling sense of determination, desire and hunger for the pursuit of "the best piece of information", which demands non-stop effort of the instructor participants in order to obtain it. Case (2007) suggested that actively acquiring information implied recognition of uncertainty or anomalies at some level. Kuhlthau (1993b) made good arguments for considering uncertainty as a beginning stage in the process of finding information. The more complex the task an instructor participant encounters, the more frequently he/she must interact with and integrate multiple types of sources of information. The fire service knowledge structures of KSA prescribe the three domain areas for firefighters to learn and train, delineate the boundaries of information sources and dictate the instructor participants' use of multiple types of sources of information in these three areas. The RPD model serves as a goal of the instructional activities and results in the instructor participants' high demands on informal/personal sources of information, in particular street experience and social networks of people.

I also identified the instructor participants' five stages of information process as seeking, gathering, sharing, integrating and presenting. Within these stages, I identified the specific attributes of digging, being open-minded, doing research, reading, observing, lifelong learning, lifetime collecting, compiling and sharing as information seekers.

I used Leckie's model as the conceptual framework for understanding the instructor participants' needs within the context of their multiple roles and complicated tasks. Based on the new findings, I tested, revised and expanded the model to capture the information-seeking and sharing behaviors of fire service field staff instructors. My expanded model provides different perspectives, including the role of professional knowledge in the information-seeking process, the group element and particular ways in which group members practice their work and look for and share information to the process. The instructor participants' complicated information-seeking process reflects the two levels of individual and collaborative information-seeking and the way they can be integrated in one model. The value of this expanded model is that it demonstrates the rich and dynamic interplay between the field staff instructors' professional work roles and tasks, personal characteristics, perceived information needs defined by professional knowledge and how those needs are met. Most importantly, this study concludes that the Leckie model does not fit well for all professionals' information-seeking.

CHAPTER 10

CONCLUSIONS

This research has focused on the complex information-seeking and sharing of field staff instructors associated with their performance on a variety of cognitive and hands-on tasks for instruction. Through this study, I have come to understand their information behaviors in the context of instructional activities. My interpretations are established on the thoughts, perspectives and experiences of the instructor participants themselves. In this last chapter, I first briefly review my research questions and bring together the key findings that have emerged from my analysis. I then discuss the theoretical and practical implications of these findings in the fire service field and LIS. I finish with the challenges and limitations of this research as well as suggestions for further studies.

10.1 RESEARCH QUESTIONS AND KEY FINDINGS

The thick descriptions offered by the instructor participants provide a picture of their information-seeking and sharing behaviors embedded in the core fire service practice of training. Table 24 summarizes the research questions investigated in the study and the key findings examined in the preceding chapters. Findings are presented for each research question.

Table 24. Research Questions and Key Findings

Research Questions	Interview Questions	Findings /Chapter No.
1. How do fire service instructors, in particular the Fire Academy's field staff instructors, organize, work and perform their training, teaching and curriculum development?	1. Tell me about your training and teaching activities at the Fire Academy. Describe and explain how you do them. 2. Describe a recent curriculum development project at the Fire Academy in which you were engaged. Please describe enough details so I can understand your process on how you did it.	. Multiple roles and complicated tasks . Multiple subject expertise . Attributes of field staff instructors . Collaborative group work Chapter 5 Chapter 8

Table 24 (cont.)

Research Questions	Interview Questions	Findings /Chapter No.
2. What view of the world and theory of work inform their instructional activities?	12. To what degree are your instructional activities that lead to your information-seeking informed by the Recognition-Primed Decision Model (RPD)?	. Uncertainty and dynamic nature of business . Task complexity . RPD model as mindset and goal of instruction . Firefighter's three domains of learning: Fire service knowledge structures of KSA . Firefighter safety . Integration of multiple sources of information . The best piece of information and the best option Chapter 9
3. What are the typical problems that lead them to engage in information-seeking while they are involved in their training, teaching and curriculum development activities?	3.1 Describe the most difficult aspect of your training and teaching as an instructor. How did you convey the Knowledge, Skills and Affective of your class to your students? 3.2 Describe the most difficult aspect of your most recent curriculum development project. 5. Have your information-seeking problems changed over time? If yes, do you account for the change, i.e., because of your daily routine (training, teaching, curriculum development and actual emergency response) or because sources of information have changed? Give specific examples.	. Uncertainty and dynamic nature of business . Task complexity . Safety of training and emergency responses . Problems rooted in work-related situations and personal interests . Information overload . Quality of digital sources Chapter 5 Chapter 6 Chapter 9
4. What kinds of information sources do they look for and where, to solve these information problems?	6. Do you rely on any particular a) Experience, b) People, c) Personal collection as top sources for your teaching, training and curriculum development? 7. How particularly helpful and important is experience to your training, teaching and curriculum development, including your own experience, other instructors' and students' experience, in classroom lecture teaching and hands-on skill training? 8. What types of information materials do you seek and use to resolve the typical problems and make decisions about your training, teaching and curriculum development project? Give specific examples, e.g., experienced instructors and officers, books, videos, magazines, etc. 9. How do you decide that you have enough information?	. Formal and institutional sources of information in print and media formats, from the library, and digital sources chiefly from the Internet . Informal and personal sources of information, such as personal social networks of people, street experience, and personal collection . Group network mediated sources of information, such as transactive memory system . Integration of multiple types of information sources

Table 24 (cont.)

Research Questions	Interview Questions	Findings /Chapter No.
	11. What would be your recommendation to someone who is starting a similar work of training, teaching and curriculum development so that they would increase their chances of finding relevant information?	Chapter 6 Chapter 7 Chapter 8 Chapter 9
5. How does collaborative teamwork affect an individual field instructor's information-seeking behavior?	10. Think about a most memorable experience of curriculum development group work that affected your information-seeking. Be sure to tell me about makeup of the group that was involved, what kind of information was sought, and where did you look, how you knew the information found was helpful to the group's performance. Please relate as many details as possible.	. Information process in groups . Transactive memory systems . Three forms of collaborative information-seeking as joint, tag team and intra-group information-seeking Chapter 8
6. What obstacles do they perceive in the search for and use of necessary information during the course of their work?	4. What obstacles are typical to your training, teaching and curriculum development work? Give specific examples.	. Uncertainty and dynamic nature of business . Task complexity . Information overload . Quality of digital sources . Integration of multiple sources of information Chapter 6 Chapter 9

There are important patterns across the sample. To summarize, from Chapter 6 to Chapter 8, the study's findings reveal that the instructor participants relied extensively on multiple types of sources of information, while seeking and sharing information during the instructional process. They treated the print sources as the most useful and highly critical sources of information, media sources as supplementary teaching aids and digital sources as the most convenient but challenging materials in terms of locating reliable information. The library satisfied the instructor participants' needs on print and media sources. Informal and personal sources of information included the instructor participants' internal and external networks of people, street experience that has been gained and accumulated from their daily work practices and personal collections they built to meet their special needs. Networks of people and personal experience were regarded as significant sources of information, particularly when the instructor participants' needs were under time constraints, or when little information was written because it was tacit knowledge embedded in personal experience. The study's findings demonstrated that the instructor participants worked in highly collaborative groups since the tasks and situations in the fire service were complex. Within the group, the instructor members' knowledge and expertise had to be well specialized and distributed in support of instructional work. Group network-mediated sources of information, especially transactive memory systems, were regarded as a critical informal source of information. The study's findings identified a number of forms of collaborative information-seeking the instructor participants take as joint, tag team and intra-group information-seeking.

In exploring the patterns of fire service field staff instructors' information-seeking and sharing behaviors in Chapter 9, the study found that the instructor participants faced task complexity, and they must interact with and integrate multiple types of information sources. I identified a range of information activities performed by the instructor participants, including seeking, gathering, sharing, integrating and presenting. As highly motivated information seekers, instructor participants' attributes were characterized as digging, being open-minded, doing research, reading, observing, lifelong learning, lifetime collecting, compiling and sharing. The instructor participants' views and theories of work were shaped by the dynamic nature of the fire service business, particularly its uncertainty and complexity, which in turn drove their intense information-seeking and sharing with ongoing and non-stop effort. The professional fire service knowledge structures of KSA defined the three domain areas of Knowledge (cognitive), Skills (psychomotor) and Affective (attitude) for firefighters to learn and train, delineated the boundaries of information sources and dictated instructor participants' use of multiple types of information sources in the three domain areas. The RPD model was regarded as a goal of the instructional activities. As a result, it guided instructor participants' high demand of informal/personal sources of information, in particular street experience and networks of people. Moreover, the instructor participants' perception of quality toward information became more significant as task complexity and uncertainty increased. Source quality played a more important role than source accessibility in fire service training. The perceived quality of the information was the decisive parameter in the instructor participants' choice of information.

In today's complex fire emergency environment, field staff instructors are required to master concepts, equipment and teamwork relevant to contemporary fire service practices, and they are also expected to develop skills in seeking out and sharing pertinent information from multiple sources. At various points throughout the preceding chapters, the instructor participants demonstrated how they actively constructed a significant amount of information as part of the instructional process. Their active orientation towards information-seeking and sharing enhanced their job performance, increased their ability to deal with task uncertainty, helped their knowledge acquisition and assisted in their maintenance of comfortable confidence with team instructors and students. Information-seeking and sharing are integral parts of field staff instructors' instructional process and activities.

This study tested, revised and expanded Leckie's model of information-seeking of professionals to reflect the information-seeking and sharing behaviors of fire service field staff instructors. It concluded that Leckie's model does not match well with the field staff instructors in the fire service.

10.2 THEORETICAL AND PRACTICAL IMPLICATIONS

The study's findings hold several implications for theoretical and practical development. The in-depth analysis of the instructor participants' thoughts, perceptions, practices, and the context in which they work offers details about this group. This analysis can be used to consider theoretical and practical implications and to make recommendations for the best information services to support the fire service field staff instructors' work and mission. In fact, few literature resources furnish clear guidelines as to how librarians and information professionals should proceed in terms of meeting their changing needs.

10.2.1 Theoretical Implications

By studying professionals working within diverse environments, LIS scholars advance the theoretical analysis of information-seeking processes (Leckie, Pettigrew, & Sylvain, 1996). Theoretically, this study aimed to enhance and extend existing conceptual frameworks of the information-seeking and sharing of professionals. The study brought together two existing models of professionals' information behavior. Taylor's IUE model served as the framework for eliciting information about field staff instructors, their typical problems, work setting and problem resolution. Leckie's model helped analyze data about their information-seeking and sharing behaviors. The third model of RPD was linked to investigate the underlying reasons for the instructor participants' information behavior.

The study's findings provide convincing evidence for the continued relevance of the conceptual framework developed by Leckie's model in the context of professional groups. The stories that instructor participants told confirmed that their work roles and tasks led to information-seeking and sharing. The data generated in this research support several of the most prominent claims in Leckie's model. The most significant contribution of this model to my study is the "process-focused" lens, which proves to be powerful and helpful in gaining a better understanding of the variety of information sources and activities involved in the instructor participants' instructional work.

This study's findings present another line of examination, expansion and enrichment of Leckie's model. The model holds only partially true for the group I studied, primarily because of its linear fashion and limitations in representing information sharing, two levels of individual and collaborative information-seeking, group knowledge and a larger cyclical process than just the process of information-seeking. By examining collaborative information-seeking and sharing, particularly transactive memory systems, this study refuted the tradition of research in information behavior that considered information-seeking from an individual perspective. The expanded model describes the instructor participants' complicated information-seeking processes in the two levels of individual and collaborative information-seeking as integrated within the one model. The instructor participants' main motivation for seeking and sharing information is the uncertain nature of the life and death fire service business, where the instructors encounter complex tasks and safety concerns. I have observed that the path of fire problem solving is not singular and fixed, but complex, bi-directional and variable. The instructor participants' searching is never ending illustrated in the expanded iterative and cyclical model of information-seeking and sharing of the fire service field staff instructors. The expanded model contributes to a more multi-dimensional view of the information-seeking process than has typically been provided. This research provides insight into the broader issue of how field staff instructors seek and share information, and it is the first to address this gap in the literature. In so doing, it helps us better understand how an information seeker tailors his or her information-seeking and sharing activities to the specifics of his or her dynamic needs and information environment.

To date, fire service field staff instructors' information-seeking and sharing has not been studied. The expanded model can be tested in similar groups of field staff instructors in other state fire academies to see what patterns of information-seeking and sharing would be parallel and equivalent. Furthermore, understanding the context of these field staff instructors may provide general insights applicable to other dynamic work contexts, such as rescue operations and emergency response teams that also require domain experts to train, teach and develop curricula by seeking, synthesizing and disseminating rapidly-changing information.

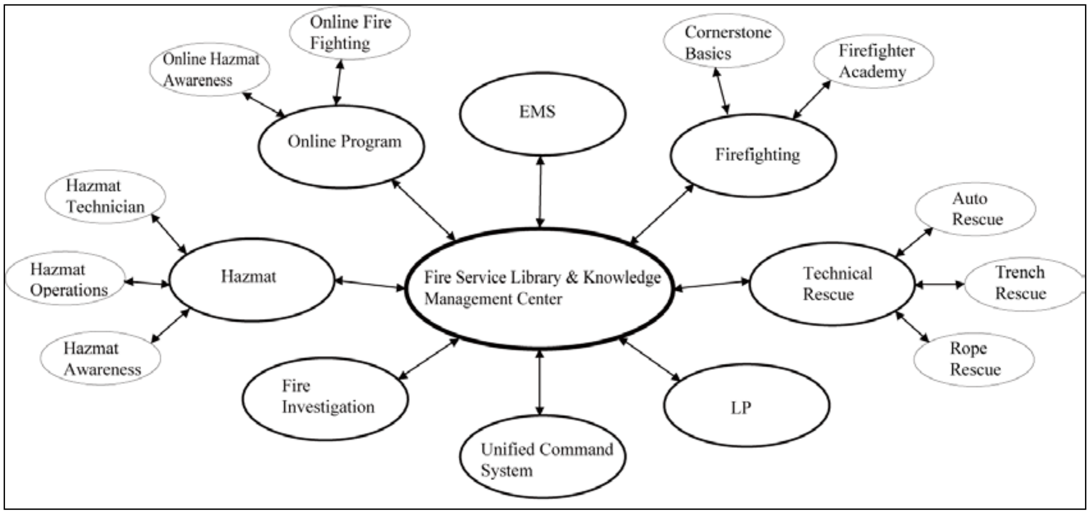
10.2.2 Practical Implications

Wilson (1981) noted that the study of information-seeking behavior could stand on its own as an area of applied research where the motive for investigation was pragmatically related to system design and development. Information services, collections and information tools in fire libraries are generally organized in traditional ways and not specifically designed to be tailored to specific user groups. Providing timely information services to meet the changing needs of field instructors is not a simple task. This study's findings are a good beginning to help us understand their highly complex information behavior. What is known from this study can be applied to existing fire information services and library programs, and this information can help to find innovative ways to further support field staff instructors' work practices.

It is hoped that support systems will be developed to reflect field staff instructors' work practices and patterns of information-seeking and sharing behaviors, which will ultimately help their ongoing efforts to integrate and synthesize their experience-based and book-based knowledge. For example, what I have learned about some field staff instructors' crossover practices can help add new elements to information organization, providing services targeting this crossover group of instructors and working with them on collection development to facilitate better crossover information gathering and learning. In fire service training, teaching and training are usually well documented through curriculum, while information about the context of the teaching and training, particularly the process and hands-on training, is typically not available because it is experience-based and difficult to index in a way that makes it accessible. During the instructional process, instructors rely highly on informal/personal and group network-mediated sources of information, which are tacit, context-dependent and personalized. The library holds little about these sources of information. Below, I outline two major suggestions on the practical implications of this study in information services that will help better serve instructors, enhance the role of the library in the instructional process, and assist instructors in advancing the fire service training of firefighters.

Knowledge Management Structure. There are successful knowledge management practices in corporate library settings that can be studied and borrowed. Knowledge management theories, such as Nonaka's knowledge transfer as a spiral process of interaction between explicit knowledge and tacit knowledge, can be informative (Nonaka & Takeuchi, 1995). Drawing on the results presented in Chapters 5-9, this study's findings suggest that librarians and information professionals should develop a systematic and structured way to manage field staff instructors' informal/personal and group network-mediated sources of information that do not exist in writing and cannot be found in the library or the archives. To bridge the librarians' and information professionals' technical knowledge gap, building a close partnership and collaboration with expert instructors and lead instructors (gatekeepers) is strategically important. This study's findings can assist fire libraries in creating a knowledge organization that effectively addresses knowledge loss, knowledge sharing and knowledge access in fire service training. They can also assist in the development of adaptable systems that can be customized to field staff instructors' profiles and reflect the influence of the various groups to which field staff instructors belong. The knowledge management structure of fire service training can be organized around the Fire Academy's major training programs with their sub-programs, as shown in Figure 10.

Figure 10. Subject- and Program-Centered Knowledge Management Structure of Fire Service Training



This knowledge management structure focuses on the information-seeking and sharing patterns of individual instructor groups that have different subject backgrounds but share similar information routines and practices. The library serves as the portal and integrative center of knowledge management to assess and validate knowledge management needs within the groups of training programs. It facilitates instructors' information-seeking and sharing among various actors in social networks and multiple types of information sources. Informal/personal sources of information, such as street experience and transactive memory systems, can be organized and made accessible in separate, yet linked archives – side by side with formal/institutional sources of information. Connecting fire terminology across information products and actors can help improve capabilities for searching multiple sources of information and multiple actors across databases. The knowledge management structure informs instructors of new work in primary interest areas; shares instructors' street experience; facilitates crossover subject information-seeking and sharing; and identifies relevant actors, places and activities in common subject areas.

I suggest tying the knowledge management structure closely to the fire service knowledge structures of KSA to represent the overall field of fire service training in the three learning domains. A knowledge management structure can be further developed to concentrate on the most critical actors in the instructors' social networks of people: the expert instructors with their multiple roles of expert, mentor, role model and source of feedback.

Fire Service Expert Instructor Database. Expert instructors play the most influential role in instructors' personal social networks of people. The database will collect their narratives along with stories regarding their respective experiences through interviewing. Organizing these stories as knowledge resources in searchable databases could be powerful and profound. Building a fire service expert instructor database with personal profiles, specializations, group memberships, key references used, networks of people and key titles in personal collections could effectively facilitate instructors' information sharing at a new level and preserve institutional and expert knowledge in a systematic way. The purpose of the database is not only to elicit expert instructors' expertise, but also to index it to support instructors in the process of finding an expert along with the key references and specific knowledge he or she often uses during instructional work. To develop such a database and classification schemes, identifying the pattern of expert instructors' information-seeking and sharing behaviors is much needed. We need to ask what information individual expert instructors are repeatedly dependent on in deciding whom to approach in a range of situations. We also need to learn to what kind of reference materials instructors refer and where they obtain them. Expert instructors' best information strategies and tactics will be documented, analyzed and integrated into the database. We must also investigate what types of information it is acceptable to record and make available to instructor searchers, and how this varies across instructors and programs.

To facilitate the synthesis of fire service knowledge and to help advance fire service training, the knowledge management structure of fire service training and the fire service expert instructor database will create new collaboration and synergy among field staff instructors, librarians, information professionals and IT staff. They will help librarians and information professionals build further capacities for information services and library programs to combine knowledge organization of informal/personal and group network-mediated sources of information with the library's traditional-centered approach of reference service and collection development of formal and codified sources of information. They will open new paths and resources for the library and its users, especially field staff instructors.

10.3 CHALLENGES AND LIMITATIONS

The information-seeking and sharing of fire service field staff instructors is a complex phenomenon. Their work is complicated and so are the fire service business and organizations in which they serve. This complexity cannot be discounted. The study has inherent potential challenges and limitations, which should not be overlooked.

The semi-structured interview method was the primary method I adopted for the study. A major challenge for me was the lack of standards to follow for my data analysis. Many published studies provided little explanation of procedures and techniques used in data analysis (Wang, 1999) and data presentation. In the data analysis stage, long pages of transcripts with fire service technical terms and descriptions were sometimes difficult to understand and synthesize. In the data presentation stage, I had to learn how to integrate data and illustrate my interpretations. The data generated by multiple data sources through multiple means seemed uneven. For example, I was unable to observe all instructor participants' classes due to availability. My first interview was shorter than other interviews due to lack of interview skills in probing questions. For the single interview, especially at the early stage of interviews, I faced the challenges Warren (2002) pointed out in that the researcher might not have enough time and opportunity to fully immerse him/herself in the single or one-shot interview process to better understand the interviewees and grab their shifting perspectives. My semi-structured interview approach served a useful function in making sure that all questions were answered and that instructor participants understood my instructions and questions. But the instructor participants might not remember things completely or accurately, perhaps affected by a number of factors, such as stress and disruptions. My interviews took two and a half months to complete. To instructor participants, events and situations could happen over this time period that might influence the answers I received. Instructor participants' different subject specializations and experiences could affect narrative accounts of their group experiences. Thus, accounts of similar group experiences are likely to vary across cultural settings (Hirokawa, DeGooyer, & Valde 2000). Since I was the one who conducted interviews, they might not feel comfortable in answering questions or give biased opinions.

Another limitation of this research pertains to the sample of participants I was able to assemble across the Fire Academy. The study was limited by the willingness of some field staff instructors who participated in the interview. They were in remote locations with 3-day working shift schedules and might have difficulty reflecting on routine training activities at a one-shot interview. As I discussed in Chapter 5, younger and female instructors were not well-represented in this sample. At the beginning of this project, I hoped that I could recruit roughly equal numbers of instructor participants from different types of fire departments, thus allowing me to draw some basic comparisons between the experiences of individual instructors working in rural areas and those working in large metropolitan areas. Most of the sample was recruited from the urban-based departments, thus making meaningful location-based comparisons difficult. I studied collaborative information-seeking and sharing in groups, but only from one individual group member's perspective, which constrained the study findings from group members' perspectives.

There are some additional strategies that could have enhanced my dataset. I had avoided carrying out multiple interviews because of a concern about instructors' availability due to busy working schedules, and this perceived concern was reinforced while making interview appointments with potential participants. In retrospect, however, additional interviews might have provided me with deeper detail about their information-seeking and sharing processes, especially decision making processes on the use of information. Also, I did not interview the Fire Academy Director to ask his perspective on the field staff instructors.

Although the results of this study offer plausible explanations as to why the instructor participants behaved as they did within this specific information environment, a generalization of the results to the population is not permitted by the research design and sampling procedure selected. The study focused on the small sample size of 25 instructor participants' instructional activities, which is only one aspect of preparing firefighters. The findings and interpretations examined specific field staff instructors and the programs for which they work in one state. They are not generalizable to fire service field staff instructors in other parts of the country, and the resulting suppositions must be further tested. However, the similarities between the types of challenges faced and types of information required imply that it is possible that the results of this study can be informative and helpful to studies of field staff instructors in other states and other emergency response professional groups' dynamic work contexts.

10.4 FUTURE STUDIES

This study is a first attempt at testing empirically the pattern of information-seeking and sharing behaviors of fire service field staff instructors. This research sheds light on many aspects of their information-seeking and sharing, yet there is much that is still not clear. The results of this study suggest the following key areas that are worthy of further investigation.

Orally-based information is used predominately in the fire service training and emergency response scene. The fire service has a strong oral tradition of stories shared by word of mouth, generation after generation. Shearing and Ericson (1991) defined oral traditions as occasions where the use of stories, narratives or instructions (both formal and informal) predominate and are focused upon work-relevant, shared values (Shearing & Ericson, 1991). The fire service oral tradition has over time developed historical, cultural and social meanings that constitute and characterize fire service knowledge. This oral tradition reflects the connections among institution-based knowledge, situated and experiential knowledge of “know how,” social knowledge of “know who,” the central concern of firefighter safety and the extraordinary characters of each instructor. Like other oral traditions, the fire service oral tradition plays a dual function in representing both the past and the present to reinforce cultural norms (Meehan, 2000; Vansina, 1985) and support knowledge production (Talja, Tuominen, & Savolanien, 2005). The collection of stories within the oral tradition is a corpus of knowledge stored within the heads of its people, such as instructors, and lacks permanence. Such collection is closely associated with the development of the knowledge management structure of fire service training and the fire service expert instructor database. Further study is needed to understand the oral tradition and how knowledge management or other approaches can be best applied to manage it. Besides the interview method, ethnography may be a good approach, for example Orr’s (1990) ethnographic study of photocopier repair technicians who employed orality to diagnose and resolve problems (Turner, 2007). Some questions should be addressed, concerning the characteristics of oral tradition in the fire service. How can we organize it, preserve it, access it and share it? Future information behavior research in the fire service should articulate this oral tradition to define its role in information-seeking and sharing processes.

This study's findings shed light on information-seeking and sharing in group contexts. Fire service training is a collection of activities in which work is accomplished by various instructors. The emerging conceptualization of group knowledge in transactive memory systems and multi-forms of collaborative information-seeking add a complementary focus on the information-seeking process. Future research can analyze group member relationships, expertise, skills, knowledge structures and transactive memory systems from *all* group members. This work may allow researchers to inductively extract effective patterns of transactive memory systems and determine how they play roles in the group members' information sharing and seeking. We need to compare the instructors' transactive memory systems that exchange knowledge and make decisions effectively with those that are not effective. Can groups have multiple transactive memory systems dealing with separate subject domains? How do they affect individual and collaborative information-seeking and sharing? More questions should be asked about how groups integrate sources of information and how those groups' information strategies and tactics compare with those of individuals. How can transactive memory systems be organized, managed, mapped and preserved in the suggested knowledge management structure of fire service training and the fire service expert instructor database? What is the roles group actors play in the instructor's social networks of people? Research on these questions can lead information behavior research to new directions and guide researchers to think of groups in new ways.

Further research needs to follow information-seeking and sharing related to changes in field staff instructors' career stages. The pattern of information-seeking and sharing may vary greatly according to the career development of a field staff instructor. The individual differences, such as novices versus experts, may affect how instructors seek and share information while forming tactics and strategies. Understanding such individual differences can be valuable in developing user training programs designed to help novice instructors learn and adopt expert instructors' information behaviors to increase their success and productivity.

This study has potential significance to the fields of fire service and LIS. The Fire Academy established the Firefighter Life Safety Research Center to conduct interdisciplinary research from engineering, medicine, computer science and kinesiology. This study's findings on the information behaviors of field staff instructors can add LIS to the Center's research approach and agenda to broaden its perspective. Today's fire service is in a critical stage as it attempts to both enhance its professionalism as well as provide expanding services in an efficient and effective manner. Comprehensive training for firefighters through field staff instructors becomes particularly important if they are to respond to emergency incidents effectively and safely. The study recognizes the important roles of field staff instructors as they create, retain and share knowledge, skills and experience in the course of teaching, training and curriculum development. The study helps gain a deeper and fuller understanding of their information-seeking and sharing behaviors in a complicated and dynamic environment.

REFERENCES

Abbott, A. (1988). *The system of professions: An essay on the division of expert labor*. Chicago: University of Chicago Press.

Agada, J. (1999). Inner-city gatekeepers: An exploratory survey of their information use environment. *Journal of the American Society for Information Science*, 50(1), 74-85.

Algon, J. (1996). Classification of tasks, steps, and information-related behaviors of individuals on project teams. In P. Vakkari, R. Savolainen, & B. Dervin (Eds.), *Information-seeking in Context: Proceedings of an International Conference on Research in Information Needs, Seeking and Use in Different Contexts* (pp. 205-221). Cambridge, UK: Taylor Graham.

Allard, S., Levine, K. J., & Tenopir, C. (2008). Design engineers and technical professionals at work: Observing information usage in the workplace. *Journal of the American Society for Information Science and Technology*, 60(3), 443-454.

Allen, T. J. (1966). Studies of the problem-solving process in engineering design. *IEEE Transactions on Engineering Management*, EM-13(2), 72-83.

Allen, T. J. (1969). Information needs and uses. In C. Cuadra (Ed.), *Annual review of information science and technology* (Vol. 4, pp. 3-29). Chicago: Encyclopedia Britannica.

Allen, T. J. (1977). *Managing the flow of technology: Technology transfer and the dissemination of technogical information within the R & D organization.* Cambridge, MA: MIT Press.

Allen, T. J. (1988). Distinguishing engineers from scientists. In R. Katz (Ed.), *Managing professionals in innovative organizations* (pp. 3-18). Cambridge, MA: Ballinger Publishing.

Allen, T. J., & Cohen, S. I. (1969). Information flow in two R&D laboratories. *Administrative Science Quarterly*, 14(1), 12-19.

Allen, T. J., Gerstenfeld, A., & Gerstberger, P. G. (1968). *The problem of internal consulting in research and development organization*. (Working Paper No. 319-368). Cambridge, MA: Massachusetts Institute of Technology.

Aloni, M. (1985). Patterns of information transfer among engineers and applied scientists in complex organizations. *Scientometrics*, 8(5-6), 279-300.

Alwis, G. de, Majid, S., & Chaudhry, A. S. (2006). Transformation in managers' information-seeking behavior: A review of the literature. *Journal of Information Science*, 32(4), 362-377.

Ancona, D. G., & Caldwell, D. F. (1988). Beyond task and maintenance: Defining external functions in groups. *Group and Organizational Studies*, 13, 468-494.

Ancona, D. G., & Caldwell, D. F. (1992). Bridging the boundary: External activity and performance in organizational teams. *Administrative Science Quarterly*, 37, 634-665.

Anderson, C. J., Glassman, M., McAfee, R. B., & Pinelli, T. (2001). An investigation of factors affecting how engineers and scientists seek information. *Journal of Engineering and Technology Management*, 18(2), 131-155.

Angle, J., Gala, M., Harlow, D., Lombardo, W., & Maciuba, C. (2008). *Firefighting strategies and tactics*. (2nd ed.). Albany, NY: Delmar Thomson Learning.

Anthony, L. J. (1986). The structure of engineering information. In L. J. Anthony (Ed.), *Information sources in engineering* (2nd ed., pp. 1-36). London: Butterworth.

Anthony, L. J., East, H., & Slater, M. J. (1969). The growth of literature of physics. *Reports on Progress in Physics*, 32, 709-767.

Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150-169.

Argyris, C., & Schön, D. A. (1974). *Theory in practice: increasing professional effectiveness*. San Francisco, CA: Jossey-Bass.

Arksey, H., & Knight, P. (1999). *Interviewing for social scientists*. London: Sage.

Arrow, H., Berdahl, J. L., Bouas, K. S., Craig, K. M., Cummings, A., Lebie, L., McGrath, J. E., O'Connor, M., Rhoades, J. A., & Schlosser, A. (1996). Time, technology and groups: An integration. *Computer Supported Cooperative Work*, 4(2/3), 253-261.

Ashford, S. J. (1986). Feedback-seeking in individual adaptation: A resource perspective. *Academy of Management Journal*, 29(3), 465-487.

Ashford, S. J., & Cummings, L. L. (1983). Feedback as an individual resource: Personal strategies of creating information. *Organizational Behavior and Human Performance*, 32, 370-398.

Ashford, S. J., & Tsui, A. S. (1991). Self-regulation for managerial effectiveness: The role of active feedback seeking. *Academy of Management Journal*, 34, 251-280.

Auster, E., & Choo, C. (1993). Environmental scanning by CEOs in two Canadian industries. *Journal of the American Society for Information Science*, 44, 194-203.

Austin, J. R. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology*, 88(5), 866–878.

Badaracco, J. (1991). Alliances speed knowledge transfer. *Planning Review*, 19(2), 10-12.

Bailey, K. D. (1994). *Methods of social research.* (4th ed.). New York: The Free Press.

Baker, L. (2006, April). Enhancing vehicle extrication instruction. *Fire Engineering*, 159(4), 163-168.

Baker, L. M. (2004). The information needs of female police officers involved in undercover prostitution work. *Information Research*, 10(1). Retrieved from http://informationr.net/ir/10-1/paper209.html

Baldridge, V., & Burnham, R. (1975). Organizational innovation: Individual, organizational and environmental impacts. *Administrative Science Quarterly*, 20(2), 165-176.

Baldwin, N. S., & Rice, R. E. (1997). Information-seeking behavior of securities analysts: Individual and institutional influences, information sources and channels, and outcomes. *Journal of the American Society for Information Science*, 48, 674-693.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Banks, M. (1994). *Banks on using a law library: A Canadian guide to legal research.* Scarborough, Ontario: Carswell.

Barr, A., & Feigenbaum, E., (Ed.) (1981). *Handbook of artificial intelligence*: Volume, I. London: Pitman.

Barzilai-Nahon, K. (2008). Toward a theory of network gatekeeping: A framework for exploring information control. *Journal of the American Society for Information Science,* 59(9), 1493-1512.

Bates, M. J. (1994). The design of databases and other information resources for humanities scholars: The Getty online searching project report no. 4. *Online and CDROM Review,* 18(6), 331-340.

Bates, M. J. (1996). Document familiarity, relevance, and Bradford's law: The Getty online searching project report no. 5. *Information Processing & Management*, 32(6), 697-707.

Bates, M. J. (1999). The invisible substrate of information science. *Journal of the American Society for Information Science*, 50(12), 1043-1050.

Batson, R. G. (1987). Characteristics of R&D Management which influence information needs. *IEEE Transactions on Engineering Management*, 34(3), 178-183.

Bazerman, M. H., Mannix, E.A., & Thompson, L.L. (1988). Groups as mixed-motive negotiations. *Advances in Group Processes*, 5, 195-216.

Belkin, N. J. (1984). Cognitive models and information transfer. *Social Science Information Studies*, 4, 111-129.

Belkin, N. J., Oddy, R. N., & Brooks, H. M. (1982). ASK for information retrieval. Parts 1 and 2. *Journal of Documentation,* 38, 61-71; 145-164.

Berger, C. R., & Calabrese, R. J. (1975). Some explorations in initial interaction and beyond: Toward a developmental theory of interpersonal communication. *Human Communication Research*, 1, 99-112.

Bernier, C. L., & Yerkey, A. N. (1979). Message diffusion. In C. L. Bernier & A. N. Yerkey, *Cogent communication: Overcoming reading overload* (pp. 118-128). Westport, CT: Greenwood Press.

Berul, L. H., Elling, M. E., Karson, A., Shafrity, A. B., & Sieber, H. (1965). *Department of Defense user needs study*. Philadelphia: Auerbach Corporation.

Bichteler, J., & Ward, D. (1989). Information-seeking behavior of geoscientists. *Special Libraries*, 79(3), 169-178.

Billett, S. (2001). *Learning in the workplace: Strategies for effective practice*. Crows Nest, NSW: Allen & Unwin.

Bin, G. (2009). Moderating effects of task characteristics on information source use: An individual-level analysis of R&D professionals in new product development. *Journal of Information Science,* 35, 527-547.

Bishop, A. P. (1994). The role of computer networks in aerospace engineering. *Library Trends*, 42(4), 694-729.

Blade, M. F. (1963). Creativity in engineering. In M. A. Coler (Ed.), *Essays on creativity in the sciences* (pp. 110-122). New York: New York University Press.

Bloom, B. S., Mesia, B. B., & Krathwohl, D. R. (1964). *Taxonomy of educational objectives*. New York: David McKay.

Booth, N., & Owen, E. (1985). The relevance of formal and informal networks for community development: Lessons learned from three cases. In F. A. Fear & H. Schwarzweller (Eds.), *Focus on community* (pp. 159-172). Greenwich, CT: JAI Press.

Borgman, C. L. (1986). Individual differences in the use of information systems. A pilot study. In J.M. Hurd (Ed.), *Proceedings of the 49th Annual Meeting of the American Society for Information Science, September 28-October 2, Chicago* (pp. 20-31). Medford, NJ: Learned Information.

Borgman, C. L. (1989). All users of information systems are not created equal: An exploration into individual differences. *Information Processing & Management*, 25, 237-251.

Borko, H., & Putnam, R. (1996). Learning to teach. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 673-708). New York, NY: Macmillan.

Bowden, V. M., Kromer, M. E., & Tobia, R. C. (1994). Assessment of physicians' information needs in five Texas counties. *Bulletin of the Medical Library Association,* 82(2), 189-196.

Bozeman, B., & Feeney, M. K. (2007). Toward a useful theory of mentoring: A conceptual analysis and critique. *Administration & Society*, 39(6), 719-739.

Bresnick, D. (1988). The lawyer as information manager. *Legal Studies Forum*, 12, 275-284.

Brewer, J., & Hunter, A. (1989). *Multimethod research: a synthesis of styles*. Newbury Park: Sage.

Brockman, W. S., Neumann, L., Palmer, C. L., & Tidline, T. (2001). *Scholarly work in the humanities and the evolving information environment.* Washington, DC: Digital Library Federation and the Council on Library and Information Resources.

Bromme, R., & Tillema, H. (1995). Fusing experience and theory: The structure of professional knowledge. *Learning and Instruction*, 5(4), 261-267.

Bronstein, J., & Baruchson-Arbib, S. (2008) The application of cost benefit and least effort theories in studies of information-seeking behavior of humanities scholars: the case of Jewish studies scholars in Israel. *Journal of Information Science*, 34(2), 131-144.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher,* 18(1), 32-42.

Brown, J. S. & Duguid, P. (1991). Organization learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, 2(1), 40-57.

Brown, J. W., & Utterback, J. M. (1985). Uncertainty and technical communication patterns. *Management Science*, 31, 301-311.

Bruce, H., Cleal, B., Fidel, R., & Pejtersen, A. M. (2004). A multimensional approach to the study of human-information interaction: A case study of collaborative information retrieval. *Journal of the American Society for Information Science and Technology,* 55(11), 939-953.

Bruce, H., Fidel, R., Pejtersen, A. M., Dumais, S., Grudin, J., & Poltrock, S. (2003). A comparison of the collaborative information retrieval behavior of two design teams. *The New Review of Information Behaviour Research,* 4(1), 139-153.

Bureau of Labor Statistics, United States. Department of Labor (2010). *Occupational outlook handbook 2010-11 Edition.* Fire Fighting Occupations. Retrieved from http://www.bls.gov/oco/ocos329.htm

Button, G., & Sharrock, W. (1996). Project work: The organization of collaborative design and development in software engineering. *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, 5, 369-386.

Byström, K. (2002). Information and information sources in tasks of varying complexity. *Journal of the American Society for Information Science and Technology*, 53(7), 581-591.

Byström, K., & Järvelin, K. (1995). Task complexity affects information-seeking and use. *Information Processing & Management*, 31(2), 191-213.

Cairns, R. W., & Compton, B. E. (1970). The SATCOM report and the engineer's information problem. *Engineering Education*, 60(5), 375-376.

Cannon-Bowers, J. A., & Salas, E. (2001). Reflections on shared cognition. *Journal of Organizational Behavior*, 22, 195-202.

Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making. In N. J. Castellan (Ed.), *Individual and group decision making* (pp.221-246). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining competencies and establishing team training requirements. In R. A. Guzzo, E. Salas, & Associates (Eds.), *Team effectiveness and decision making in organizations* (pp. 333-380). San Francisco, CA: Jossey-Bass.

Carney, T. F. (1990). *Collaborative inquiry methodology*. Windsor, Ontario, Canada: University of Windsor, Division for Instructional Development.

Carter, H. R., & Rausch, E. (1999). *Management in the fire service.* Quincy, MA: National Fire Protection Association.

Case, D. O. (2002). *Looking for information: A survey of research on information-seeking, needs and behavior*. San Diego, CA: Academic Press.

Case, D. O. (2007). *Looking for information: A survey of research on information-seeking, needs and behavior*. (2nd ed.). San Diego, CA: Academic Press.

Case, D., & Borgman, C. L. (1986). End-user information-seeking in the energy field: Implications for end-user access to DOE/RECON databases. *Information Processing & Management*, 22(4), 299-308.

Chakrabarti, A. K., Feineman, S., & Fuentevilla, W. (1983). Characteristics of sources, channels, and contents for scientific and technical information systems in industrial R and D. *IEEE Transactions on Engineering Management*, 30(2), 83-88.

Chalos, P., & Pickard, S. (1985). Information choice and cue use: An experiment in group information processing. *Journal of Applied Psychology*, 70, 634-641.

Charmaz, K. (1995). Grounded theory. In J. A. Smith, R. Harre, & L. V. Langenhove (Eds.), *Rethinking methods in psychology* (pp. 27-49). Thousand Oaks, CA: Sage Publications.

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*, (2nd ed., pp. 509-535). Thousand Oaks, CA: Sage Publications.

Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 675-694). Thousand Oaks, CA: Sage Publications.

Chen, C., & Hernon, P. (1982). *Information-seeking: Assessing and anticipating user needs*. New York: Neal Schuman.

Choo, C. W. (1994). Perception and use of information sources by chief executives in environmental scanning. *Library & Information Science Research*, 16, 23-40.

Choo, C. W. (2001a). Environmental scanning as information-seeking and organizational learning. *Information Research*, 7 (1). Retrieved from http://informationr.net/ir/7-1/infres71.html

Choo, C. W. (2001b). *Information management for the intelligent organization: The art of scanning the environment*. Medford, NJ: Information Today.

Choo, C. W., Detlor, B. & Turnbull, D. (2000). *Web work: information-seeking and knowledge work on the World Wide Web*. Boston: Kluwer Academic Publishers.

Cicourel, A. V. (1990). The integration of distributed knowledge in collaborative medical diagnosis. In J. Galegher, R.E. Kraut, & C. Egido (Eds.), *Intellectual teamwork* (pp. 221-242). Hillsdale, NJ: Lawrence Erlbaum Associates.

Clark, N. K., & Stephenson, G. M. (1989). Group remembering. In P. Paulus (Ed.), *Psychology of group influence* (2nd ed., pp. 357-391). Hillsdale, NJ: Erlbaum.

Cohen, A. L., Maglio, P. P. & Barrett, R. (1998, November). *The expertise browser: how to leverage distributed organizational knowledge.* Paper presented at the conference on Computer Supported Cooperative Work (CSCW'98) Workshop on Collaborative Information-seeking, Seattle, WA.

Cohen, L., & Manion, L. (1997). *Research methods in education.* (4th ed.). London: Routledge.

Cohen, M. (1969). Research habits of lawyers. *Jurimetrics Journal*, 9, 183-194.

Cohen, M., Berring, R. C., & Olson, K. C. (1989). *How to find the law*. St. Paul, Minn.: West.

Coleman, J., Katz, D., & Menzel, I. (1966). *Diffusion of innovation*. New York: Free Press.

Coleman, R. J. (2002, July). No place in fire service for lifelong learning shortcuts. *Fire Chief*, 46(7), 20-22.

Coleman, R. J. (2004). Fire service of today. In S. Clark (Ed.), *Firefighting handbook, basic essentials of firefighting* (Chapter 1, pp. 18-19). Clifton Park, NY: Thomson, Delmar Learning.

Combs, B. (2008). Akron airdock fire, a different kind of building, a different kind of call. *NFPA Journal*, 102(4), 56-61.

Connelly, F., & Clandinin, D. (1985). Personal practical knowledge and the modes of knowing: Relevance for teaching and learning. In E. Eisner (Ed.), *Learning and teaching the ways of knowing, 84th Yearbook of the National Society for the Study of Education* (pp. 174-198). Chicago, IL: University of Chicago.

Corbin, J. M. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. (3rd ed.). Los Angeles, CA: Sage Publications.

Corbin, J. M., & Strauss, A. L. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology*, 13(1), 3-21.

Correia, Z., & Wilson, T. D. (2001). Factors influencing environmental scanning in the organizational context. *Information Research*, 7(1). Retrieved from http://InformationR.net/ir/7-1/infres71.html

Cote, A. E. (Ed.) (2003). *Fire protection handbook*. (19th ed.). Quincy, MA: National Fire Protection Association.

Court, A. W. (1997). The relationship between information and personal knowledge in new product development. *International Journal of Information Management*, 17, 123-138.

Court, A. W., Ullman, D. G., & Culley, S. J. (1998). A comparison between the provision of information to engineering designers in the UK and the USA. *International Journal of Information Management*, 18(6), 409-425.

Covell, D. G., Uman, G. C., & Manning, P. R. (1985). Information needs in office practice: Are they being met? *Annals of Internal Medicine*, 103, 596-599.

Crabtree, A., Twidale, M. B., O'Brien, J., & Nichols, D. M. (1997). Talking in the library: Implications for the design of digital libraries. In *Proceedings of the Second ACM Conference on the Theory and Practice of Digital Libraries* (pp. 221-228). New York: ACM Press.

Crane, D. (1971). Information needs and uses. In C. A. Cuadra & A. W. Luke (Eds.), *Annual review of information science and technology* (Vol. 6, pp. 3-39). Chicago: Encyclopedia Britannica.

Crane, D. (1972). *Invisible colleges*. Chicago: University of Chicago Press.

Cranefield, J., & Yoong, P. (2009). Crossings: Embedding personal professional knowledge in a complex online community environment. *Online Information Review*, 33(2), 257-275.

Crawford, S. (1971). Informal communication among scientists in sleep research. *Journal of the American Society for Information Science*, 22(5), 301-310.

Cronin, B. (1982). Invisible colleges and information transfer: A review and commentary with particular reference to the social sciences. *Journal of Documentation*, 38(3), 212-236.

Culnan, M. J. (1983). Environmental scanning: The effects of task complexity and sources accessibility on information gathering behavior. *Decision Sciences*, 14(2), 194-206.

Daft, R. L., & Lengel, R. H. (1986). Information richness: A new approach to manager information processing and organization design. *Research in Organizational Behavior*, 32(5), 554-571.

Daft, R. L., Sormunen, J., & Parks, D. (1988). Chief executive scanning, environmental characteristics, and company performance: An empirical study. *Strategic Management Journal*, 9, 123-139.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

Davidson, C., & Voss, P. (2002). *Knowledge management: An introduction to creating competitive advantage from intellectual capital*. Auckland: Tandem Press.

Deng, L., & Poole, M. S. (2008). Learning through ICT-enabled social networks. *International Journal of Information Technology and Management*, 7(4), 374-391.

Dennis, C. (2000). *Firefighter's handbook: Essentials of firefighting and emergency response*. Clifton Park, NY: Thomson, Delmar Learning.

Denzin, N. K., & Lincoln, Y. S. (1998). Entering the field of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Collecting and interpreting qualitative materials* (pp. 1-34). London: Sage.

Dervin, B. (1983a). Information as a user construct: The relevance of perceived information needs to synthesis and interpretation. In S. A. Ward & L. J. Reed (Eds.), *Knowledge structure and use: Implications for synthesis and interpretation* (pp. 153-183). Philadelphia: Temple University Press.

Dervin, B. (1983b). *An overview of sense-making research, concepts, methods and results to date.* Seattle, WA: University of Washington School of Communications.

Dervin, B. (1999). On studying information seeking methodologically: The implications of connecting metatheory to method. *Information Processing & Management*, 35, 727-750.

Devault, M. L. (2002). Talking and listening from women's standpoint: Feminist strategies for interviewing and analysis. In D. Weinberg (Ed.), *Qualitative research methods* (pp. 88-111). Malden, MA: Blackwell Publishers.

Dodson, D. (2004a). Firefighter safety. In *Firefighting handbook, basic essentials of firefighting* (Chapter 5, pp. 106-122). Clifton Park, NY: Delmar/Thomson Learning.

Dodson, D. (2004b). Personal protective clothing and ensembles. In *Firefighting handbook, basic essentials of firefighting* (Chapter 6, pp. 125-140). Clifton Park, NY: Delmar/Thomson Learning.

Doise, W. (1969). Intergroup relations and polarization of individual and collective judgments. *Journal of Personality and Social Psychology*, 12, 136-143.

Donat, J. F., & Pettigrew, K. E. (2002). The final context: Information behaviour surrounding the dying patient. *The New Review of Information Behaviour Research: Studies of Information-seeking in Context (Proceedings of ISIC 2002)*, 3, 175-186.

Du Preez, M. (April 2008). Information Needs and information-Seeking Behaviour of Consulting Engineers: A Qualitative Investigation. Dissertation at University of South Africa. Retrieved from http://uir.unisa.ac.za/bitstream/10500/1941/1/dissertation.pdf

Dumais, S., Grudin, J., Poltrock, S., Bruce, H., Fidel, R., & Pejtersen, A. M., (2000). Collaborative Information Retrieval (CIR). *New Review of Information Behaviour Research: Studies of Information-seeking in Context*, 1(1), 235-247.

Dwyer, D. J., Fowlkes, J. E., Oser, R. L., Salas, E., & Lane, N. E. (1997). Team performance measurement in distributive environments: The TARGETs methodology. In M. T. Brannick, E. Salas, & C. Prince (Eds.), *Team performance assessment and measurement: Theory, methods, and applications* (pp. 331-356). Mahwah, NJ: Lawrence Erlbaum Associates.

Edmondson, A. (2003). Managing the risk of learning: Psychological safety in work teams. In M. A. West, D. Tjosvold & K. G. Smith (Eds.), *International handbook of organizational teamwork and cooperative working* (pp. 255-275). West Sussex, England: John Wiley & Sons.

Edwards, R. (1994). Professionalism in the fire service. *FireHouse*, 19(3), 96, 134.

Elbaz, F. (1983). *Teacher thinking: A study of practical knowledge*. London: Falmer Press.

Ellis, D. (1989). A behavioural approach to information retrieval design. *Journal of Documentation*, 45, 171-212.

Ellis, D., Cox, D., & Hall, K. (1993). A comparison of information seeking patterns of researchers in the physical and social sciences. *Journal of Documentation*, 49, 356-369.

Ellis, D., & Haugan, M. (1997). Modeling the information-seeking patterns of engineers and research scientists in an industrial environment. *Journal of Documentation*, 53(4), 384-403.

Ellis, D. G., & Fisher, M. (1994). *Small group decision making* (4th ed.). New York: McGraw-Hill.

Ely, J. W., Burch, R. J., & Vinson, D. C. (1992). The information needs of family physicians: Case-specific clinical questions. *Journal of Family Practice*, 35, 265-269.

Ertel, M., & Berk, G. C. (1998). *Firefighting, basic skills and techniques*. Tinley Park, IL: Goodheart-Willcox.

Estepp, M. H. (1993). Professionalism: national fire service certification. *FireHouse*, 18(11), 54, 56-57.

Fahy, R.F. (2006). United States firefighting deaths related to training 1996-2005. *NFPA Journal*, 100(4), 40-49.

Fahy, R. F., & LeBlanc, P. R. (2004). Firefighter fatalities in the United States. *NFPA Journal*, 98(4), 44-57.

Fahy, R. F., & LeBlanc, P. R. (2005). Firefighter fatalities in the United States. *NFPA Journal*, 100(4), 50-63.

Fahy, R. F., LeBlanc, P. R., Molis, J. L., & National Fire Protection Association. (2009). *Firefighter fatalities in the United States-2008*. Quincy, Mass: National Fire Protection Association.

Faraj, S., & Xiao, Y. (2006). Coordination in fast-response organizations. *Management Science*, 52, 1155-1169.

Farhoomand, A. F., & Drury, D. H. (2002). Managerial information overload. *Communications of the ACM*, 45(10), 127-131.

Fedor, D. B., Rensvold, R. B., & Adam, S. M. (1992). An investigation of factors expected to affect feedback seeking: A longitudinal field study. *Personnel Psychology*, 45, 779-805.

Ferguson, E. S. (1992). *Engineering and the mind's eye.* Cambridge, MA: MIT Press.

Fidel, R., & Green, M. (2004). The many faces of accessibility: Engineers' perception of information sources. *Information Processing & Management*, 40(3), 563-581.

Fidel, R., Pejtersen, A. M., Cleal, B., & Bruce, H. (2004). A multidimensional approach to the study of human-information interaction: A case study of collaborative information retrieval. *Journal of the American Society for Information Science,* 55(11), 939-953.

Fiedler, F. E. (1967). *A theory of leadership effectiveness.* New York: McGraw-Hill.

Fishenden, R. M. (1965). Information use studies part 1 – past results and future needs. *Journal of Documentation*, 21(3), 163-168.

Fisher, W. R. (1984). Narration as human communication paradigm: The case of public moral argument. *Communication Monographs*, 51, 1-22.

Fontana, A., & Frey, J. H. (1998). Interviewing: the art of science. In N. K. Denzin & Y. S. Lincoln (Eds.), *Collecting and interpreting qualitative materials*. (Introduction p. 47-78). London: Sage.

Forsman, D. P. (2003). Training fire and emergency services. In A. E. Cote (Ed.), *Fire protection handbook* (pp. 225-235). Quincy, MA: National Fire Protection Association.

Forsythe, D. E., Buchanan, B. G., Osheroff, J. A., & Miller, R. A. (1992). Expanding the concept of medical information: An observational study of physicians' information needs. *Computers and Biomedical Research*, 25, 181-200.

Foster, J. (2006). Collaborative information-seeking and retrieval. *Annual Review of Information Science & Technology*, 40, 329-356.

Frazier, P., Hooper R., Orgen, B., Hankin, N. & Williams, J. (2003). *Current status, knowledge gaps, and research needs pertaining to firefighter radio communication systems, final report*. Arlington, VA: TriData Corporation.

Freund, L., Toms, E. G., & Waterhouse, J. (2005). Modeling the information behavior of software engineers using a work-task framework. In A. Grove (Ed.), *ASIS&T '05: Proceedings of the Annual Meeting of the American Society for Information Science and Technology* (Vol. 42, pp. 187-214). Silver Spring, MD: American Society for Information Science and Technology.

Fritz, R. A. (1997). *Tools of the trade, firefighting hand tools and their use*. Fire Engineering Books & Videos.

Furey, B. (2002a). Battle of the bands: choosing the radio system that's right for your department. *Firehouse*, 27(5), 40, 43.

Furey, B. (2002b). Communications size-up: a progress report. *Firehouse*, 27(8), 132-133.

Furey, B. (2002c). Writing radio specs. *Firehouse*, 25(9), 28-32.

Galegher, J., Kraut R. E., & Egido, C. (1990). *Intellectual teamwork: Social and technological foundations of cooperative work*. Hillsdale, NJ: Erlbaum.

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction.* (7th ed.). Boston: Allyn and Bacon.

Garvey, W. D. (1979). *Communication: The essence of science. Facilitating information exchange among librarians, scientists, engineers and students*. Oxford: Pergamon Press.

Garvey, W. D., & Griffith, B. (1968). Informal channels of communication in the behavioral sciences: Their relevance in the structuring of formal or bibliographic communication. In E. B. Montgomery (Ed.), *The foundations of access to knowledge* (pp. 129-151). Syracuse, NY: Syracuse University.

Gersick, C. J. G., & Hackman, J. R. (1990). Habitual routines in task-performing groups. *Organizational Behavior & Human Decision Processes*, 47(1), 65-97.

Gerstberger, P., & Allen, T. (1968). Criteria used by research and development engineers in the selection of an information source. *Journal of Applied Psychology*, 52(4), 272-279.

Gerstenfeld, A., & Berger, P. (1980). An analysis of utilization differences for scientific and technical information. *Management Science*, 26(2), 165-179.

Glaser, B. G. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory*. Mill Valley, CA: Sociology Press.

Gorman, G. E., & Clayton, P. (1997). *Qualitative research for the information professional: A practical handbook*. London: Library Association Publishing.

Gorman, P. N. (1995). Information needs of physicians. *Journal of the American Society for Information Science*, 46(10), 729-736.

Gorman, P. N., & Helfand, M. (1995). Information-seeking in primary care: How physicians choose which clinical questions to pursue and which to leave unanswered. *Medical Decision Making*, 15, 113-119.

Gouran, D. S., & Hirokawa, R. Y. (2003). Effective decision making and problem solving in groups. In R. Y. Hirokawa, R. S. Cathcart, L. A. Samovar, & L. D. Henman (Eds.), *Small group communication, theory and practice, an anthology* (Chapter 4, pp. 27-38). (8th ed.). Los Angeles, CA: Roxbury Publishing.

Govindarej, R., Pejtersen, A. M., & Carstensen, P. (1997). An information system based on empirical studies of engineering designers. *Computational Cybernetics and Simulation*, 1, 708-713.

Gralewska-Vickery, A. (1976). Communication and information needs of earth science engineers. *Information Processing & Management*, 12, 251-282.
Gray, D. E. (2004). *Doing research in the real world*. London: Sage Publications.

Griffith, B. C. (Ed.). (1980). *Key papers in information science*. White Plains, N.Y.: Published for the American Society for Information Science by Knowledge Industry Publications.

Gruppen, L. D. (1990). Physician information-seeking: Improving relevance through research. *Bulletin of the Medical Library Association*, 78(2), 165-172.

Guinan, P. J., Cooprider, J. G., & Faraj, S. (1998). Enabling software development team performance during requirements definition: A behavioral versus technical approach. *Information Systems Research*, 9(2), 101-125.

Guzzi, A. F. (2007). The fire academy instructor, characteristics of a good educator. *Fire Engineering*, 160(4), 245-246.

Hackman, J. R. (1990). *Groups that work (and those that don't): creating conditions for effective teamwork*. The Jossey-Bass management series. San Francisco: Jossey-Bass.

Hall, J. R., & Karter, M. J. (2004). *A needs assessment of the fire service, Illinois*. Quincy, MA: National Fire Protection Agency.

Hansen, P., & Järvelin, K. (2004). Collaborative information searching in an information intensive work domain: Preliminary results. *Journal of Digital Information Management*, 2(1), 26-30.

Hansen, P., & Järvelin, K. (2005). Collaborative information retrieval in an information-intensive domain. *Information Processing & Management*, 41(5), 1101-1119.

Hardy, A. (1982). The selection of channels when seeking information: Cost/benefit vs. least effort. *Information Processing & Management*, 18(6), 289-293.

Hartwick, J., Sheppard, B. H., & Davis, J. H. (1982). Group remembering: Research and implications. In R. A. Guzzo (Ed.), *Improving group decision making in organizations* (pp. 41-72). San Diego, CA: Academic Press.

Haruna, I., & Mabawonku, I. (2001). Information needs and seeking behaviour of legal practitioners and the challenges to law libraries in Lagos, Nigeria. *International Information and Library Review*, 33(1), 69-88.

Hastie, R. (1986). Experimental evidence on group accuracy. In B. Grofman & G. Owen (Eds.), *Decision research* (Vol.2, pp. 129-157). Greenwich, CT: JAI Press.

Haug, J. D. (1997). Physicians' preferences for information sources: A meta analytic study. *Bulletin of the Medical Library Association*, 85(3), 223-232.

Hause, M. L., & Woodroffe, M. R. (2001). Team performance factors in distributed collaborative software development. In G. Kadoda (Ed.), *Proc. PPIG 13* (pp. 71-82). Bournemouth, UK: 13th workshop of the psychology of programming interest group. Retrieved from www.ppig.org/papers/13th-hause.pdf

Haythornthwaite, C. (1996) A social network study of the growth of community among distance learners. *Information Research*, 4(1), paper 49. Retrieved from http://informationr.net/ir/4-1/paper49.hml

Henderson, K. (1999). *On line and on paper: visual representations, visual culture, and computer graphics in design engineering*. Cambridge, MA: The MIT Press.

Henman, L. D., & L. D. Henman (2003). Groups as systems. In R. Y. Hirokawa, R. S. Cathcart, L. A. Samovar, & L. D. Henman, (Eds.), *Small group communication, theory and practice, an anthology* (Chapter 1, pp. 3-7). (8th ed.). Los Angeles, CA: Roxbury Publishing Company.

Henry, R. A. (1995). Using relative confidence judgments to evaluate group effectiveness. *Basic and Applied Social Psychology*, 16, 333-350.

Herner, S. (1954). Information gathering habits of workers in pure and applied science. *Industrial and Engineering Chemistry*, 46(1), 228-236.

Herner, S., & Herner, M. (1967). Information needs and uses in science and technology. In C. A. Cuadra (Ed.), *Annual review of information science and technology* (Vol. 2, pp. 1-34). Chicago: Encyclopedia Britannica.

Hersberger, J. A. (2003). A qualitative approach to examining information transfer via social networks among homeless populations. *New Review of Information Behavior Research*, 4(1), 95-108.

Hertzum, M. (1999). Six roles of documents in professionals' work. In S. Bødker, M. Kyng, & K. Schmidt (Eds.). *ECSCW'99: Proceedings of the Sixth European Conference on Computer Supported Cooperative Work* (pp.41-60). Dordrecht: Kluwer.

Hertzum, M. (2000). People as carriers of experience and sources of commitment: information-seeking in a software design project. *New Review of Information Behavior Research*, 1, 135-149.

Hertzum, M. (2002). The importance of trust in software engineers' assessment and choice of information sources. *Information and Organization*, 12(1), 1-18.

Hertzum, M. (2008). Collaborative information-seeking: The combined activity of information-seeking and collaborative grounding. *Information Processing & Management*, 44(2), 957-962.

Hertzum, M. (2010). Breakdowns in collaborative information-seeking: A study of the medication process. *Information Processing & Management*, 46(6), 646-655.

Hertzum, M., Andersen, H. H., Andersen, V., & Hansen, C. B. (2002). Trust in information sources: seeking information from people, documents, and virtual agents. *Interacting with Computers,* 14(5), 575-599.

Hertzum, M., & Pejtersen, A. M. (2000). The information-seeking practices of engineers: searching for documents as well as for people. *Information Processing & Management,* 36(5), 761-778.

Hewins, E. T. (1990). Information need and use studies. In M.E. Williams (Ed.), *Annual review of information science and technology* (Vol. 25, pp. 145-172). New York: Elsevier.

Hinsz, V. B. (1990). Cognitive and consensus processes in group recognition memory performance. *Journal of Personality and Social Psychology,* 59, 705-718.

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin,* 121(1), 43-64.

Hinsz, V. B., Vollrath, D. A., Nagao, D. H., & Davis, J. H. (1988). Comparing the structure of individual and small group perceptions. *International Journal of Small Group Research*, 4, 159-168.

Hirokawa, R. Y. (1990). The role of communication in group decision-making efficacy. *Small Group Research,* 21, 190-204.

Hirokawa, R. Y., DeGooyer, D., & Valde, K. (2000). Using narratives to study task group effectiveness. *Small Group Research,* 31, 573-591.

Hirokawa, R. Y., & Poole, M. S. (1986). *Communication and group decision making.* Newbury Park, CA: Sage.

Hirsh, S., & Dinkelacker, J. (2004). Seeking information in order to produce information: An empirical study at Hewlett Packard Labs. *Journal of the American Society for Information Science and Technology*, 55(9), 807-817.

Hogg, I. H., & Smith, J. R. (1959). Information and literature use in a research and development organization. In *Proceedings of the International Conference on Scientific Information, Washington, D.C., November 16-21, 1958*. (Vol. 1, pp. 131-162). Washington, D.C.: National Academy of Sciences; National Research Council.

Holiday, S. C. (2006, February). Back to basics: Not just for students. *Fire Engineering*, 159(2), 109-112.

Holland, M. P., & Powell, C. K. (1995). A longitudinal survey of the information-seeking and use habits of some engineers. *College and Research Libraries*, 56(1), 7-15.

Hollingshead, A. B. (1998a). Communication, learning, and retrieval in transactive memory systems. *Journal of Experimental Social Psychology*, 34, 423-442.

Hollingshead, A. B. (1998b). Retrieval processes in transactive memory systems. *Journal of Personality and Social Psychology*, 74, 659-671.

Hollingshead, A. B. (1998c). Distributed knowledge and transactive processes in groups. In M. A. Neale, E. A. Mannix, & D. H.Gruenfeld (Eds.), *Research on managing groups and teams* (Vol. 1, pp.103-124). Greenwich, CT: JAI Press.

Hollingshead, A. B. (2000). Perceptions of expertise and transactive memory in work relationships. *Group Processes and Intergroup Relations,* 3, 257-267.

Hollingshead, A. B. (2001). Cognitive interdependence and convergent expectations in transactive memory. *Journal of Personality and Social Psychology*, 81, 1080-1089.

Huotari, M.-L., & Chatman, E. A. (2001). Using everyday life information-seeking to explain organizational behavior. *Library & Information Science Research*, 23(4), 351-366.

Hurd, J. M., Weller, A. C., & Curtis, K. L. (1992). Information-seeking behavior of faculty: Use of indexes and abstracts by scientists and engineers. *Proceedings of the American Society for Information Science*, 29, 136-143.

Hyldegård, J. (2006). Collaborative information behavior – exploring Kuhlthau's information search process model in a group-based educational setting. *Information Processing & Management*, 42, 276-298.

Hyldegård, J. (2009). Beyond the search process – Exploring group members' information behavior in context. *Information Processing & Management*, 45 (1), 142-158.

Ickes, W., & Gonzalez, R. (1994). "Social" cognition and social cognition: From the subjective to the intersubjective. *Small Group Research*, 25, 294-315.

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From I-P-O models to IMOI models. *Annual Review of Psychology*, 56, 517-543.

Ingwersen, P. (1984). Psychological aspects of information retrieval. *Social Science Information Studies*, 4, 83-95.

Ingwersen, P. (1992). *Information retrieval interaction.* London: Taylor Graham.

Innami, I. (1994). The quality of group decisions, group verbal behavior, and intervention. *Organizational Behavior and Human Decision Processe*s, 60, 409-430.

International Association of Fire Chiefs & National Fire Protection Association. (2006). *Fire officer, principles and practice*. Sudbury, MA: Jones and Bartlett Publishers.

International Fire Service Training Association. (1990). *Fire service instructor* (5th ed.). Stillwater, OK: Fire Protection Publications, Oklahoma State University.

International Fire Service Training Association. (1998). *Essentials of firefighting* (4th ed.). Stillwater, OK: Fire Protection Publications, Oklahoma State University.

International Fire Service Training Association. (1999). *Fire and emergency service instructor* (6th ed.). Stillwater, OK: Fire Protection Publications, Oklahoma State University.

Jensen, R., & Szulanski, G. (2004). Stickiness and the adaptation of organizational practices in cross-border knowledge transfers. *Journal of International Business Studies,* 35, 508-523.

Joenk, R. J. (1985). Engineering text for engineers. In D. H. Jonassen (Ed.), *Technology of Text: Vol. II Principles for structuring, designing, and displaying text* (Chapter 15, pp. 346-369). Englewood Cliffs, NJ: Educational Technology Publications.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review*, 88, 67-85.

Jones, R. C., LeBold, W. K., & Pernicka, B. J. (1986). Keeping up to date and solving problems in engineering. In L. P. Grayson & J. M. Biedenbach (Eds.), *World Conference on Continuing Engineering Education, Proceedings: IEEE*, May 7-9, 1986, Lake Buena Vista, Florida (pp. 784-791). New York, NY: Institute of Electrical and Electronics Engineers.

Kaplan, M. F., & Miller. C. E. (1987). Group decision making and normative versus information influence: Effects of type of issue and assigned decision rule. *Journal of Personality and Social Psychology*, 53, 306-313.

Karau, S. J., & Kelly, J. R. (1992). The effects of time scarcity and time abundance on group performance quality and interaction process. *Journal of Experimental Social Psychology*, 28, 542-571.

Kari, J. (2009). Informational uses of spiritual information: an analysis of messages reportedly transmitted by extraphysical means. *Journal of Information Science*, 35, 453-468.

Karter, M. J. (2005). *U.S. Fire Department profile through 2003*. Quincy, MA: National Fire Protection Association.

Katz, R., & Tushman, R. (1979). Communication patterns, project performance and task characteristics: An empirical evaluation and integration in an R&D setting. *Organizational Behavior and Human Performance,* 23, 139-162.

Katzer, J., & Fletcher, P. (1992). The information environment of managers. In M. Williams (Ed.), *Annual Review of Information Science and Technology* (Vol. 27, pp. 227-263). Medford, NJ: Learned Information.

Kaufman, H. G. (1983). *Factors related to use of technical information in engineering problem solving.* Brooklyn, NY: Polytechnic Institute of New York.

Kaye, B., & Jordan-Evans, S. (2005). *Love 'em or lose em: Getting good people to stay*. San Francisco, CA: Berrett-Koehler.

Kemper, J. D. (1982). *Engineers and their profession.* (3rd ed.). New York: Holt, Rinehart and Winston.

Kemper, J. D. (1990). *Engineers and their profession.* (4th ed.). Philadelphia: Saunders College Pub.

Kennedy, J. M., Pinelli, T. E., Barclay, R. O., & Bishop, A. P. (1997). Distinguishing engineers from scientists – the case for an engineering knowledge community. In T. E. Pinelli, R. O. Barclay, J. M. Kennedy, & A. P. Bishop (Eds.), *Knowledge diffusion in the U.S. aerospace industry* (pp. 177-213). Greenwich, CT: Ablex.

Kennedy, R. (1996, February 22). Changing a culture of courage. *The New York Times*. Retrieved from http://query.nytimes.com/gst/fullpage.html?res=9906E0DE1039F931A15751C0A960958260&sec=&spon=&partner=permalink&exprod=permalink

Kent, A. (Ed.). (1989). *Encyclopedia of library and information science,* Vol. 44. New York: Marcel Dekker, Inc.

Kerins, G., Madden, R., & Fulton, C. (2004). Information-seeking and students studying for professional careers: the cases of engineering and law students in Ireland. *Information Research*, 10(1), 1-16. Retrieved from http://informationr.net/ir/10-1/paper208.html

King, D. W., Casto, J., & Jones, H. (1994). *Communication by engineers: A literature review of engineers' information needs, seeking processes, and use.* Washington, DC: Council on Library Resources.

King, D. W., & Griffiths, J-M. (1991). Indicators of the use, usefulness and value of scientific and technical information. In D. I. Raitt (Ed.), *Online Information 91, Proceedings of the 15th International Online Information Meeting* (pp. 361-377). Oxford: Learned Information (Europe).

Kirschman, E. (2004). *I love a fire fighter, what the family needs to know*. New York: The Guilford Press.

Klein, G. A. (1988). Naturalistic models of C^3 decision-making. In S. E. Johnson & A. H. Levis (Eds.). *Science of command and control: Coping with uncertainty* (Chapter 10, pp. 86-92). Washington, DC: AFCEA International Press.

Klein, G.A. (1989). Recognition-primed decisions. In W. Rouse (Ed.), *Advances in man-machine systems research* (Vol. 5, pp. 47-92). Greenwich, CT: JAI Press.

Klein, G. A. (1993). A recognition-primed decision (RPD) model of rapid decision making. In G. A. Klein, J. Orasanu, R. Calderwood, & C. E. Zsambok (Eds.), *Decision making in action: Models and methods* (pp. 138-147). Norwood, NJ: Ablex Pub.

Klein, G. A., Calderwood, R., & Clinton-Cirocco, A. (1986). Rapid decision-making on the fire ground. *Proceedings on the 30th Annual Human Factors Society*, 1, 576-580. Dayton, OH: Human Factors Society.

Klein, G. A., & Klinger, D. (1991). Naturalistic decision making. *Human Systems IAC Gateway*, XI(3), 16-19.

Klein, G. A., Orasanu, J., Calderwood, R., & Zsambok, C.E. (1993). (Eds.). *Decision making in action: Models and methods*. Norwood, NJ: Ablex Publishing.

Klobas, J. E., & McGill, T. (1995). Identification of technological gatekeepers in the information technology profession. *Journal of the American Society for Information Science*, 46(8), 581-589.

Koenig, M. E. D., & Wilson, T. D. (1996). Productivity growth: The take-off point. *Information Processing & Management*, 32(2), 247-254.

Koonce, R. (2004). Fire hose and appliances. In *Firefighter's handbook, basic essentials of firefighting* (Chapter 10, pp. 219-278). Clifton Park, NY: Delmar/Thomson Learning.

Kramer, W. M. (1995). Training and education. In J. R. Bachtler & T. F. Brennan (Eds.), *The fire chief's handbook* (Chapter 10, pp. 325-351). Fire Engineering Books & Videos, PennWell Publishing.

Kraut, R. E., & Streeter, L.A. (1995). Coordination in software development. *Communications of the ACM*, 38(3), 69-81.

Kremer, J. M. (1980). *Information flow among engineers in a design company*. Doctoral dissertation, University of Illinois at Urbana-Champaign, 1980.

Kuhlthau, C. C. (1990). Validating a model of the search process. A comparison of academic, public, and school library users. *Library & Information Science Research*, 12, 5-31.

Kuhlthau, C. C. (1991). Inside the search process: Information-seeking from the user's perspective. *Journal of the American Society for Information Science*, 42(5), 361-371.

Kuhlthau, C. C. (1993a). *Seeking meaning: A process approach to library and information services*. Norwood, NJ: Ablex Publishing.

Kuhlthau, C. C. (1993b). A principle of uncertainty for information-seeking. *Journal of Documentation*, 49, 339-355.

Kuhlthau, C. C., & Tama, S. L. (2001). Information search process of lawyers, a call for 'just for me' information services. *Journal of Documentation*, 57, 25-43.

Kwasitsu, L. (2003). Information-seeking behavior of design, process and manufacturing engineers. *Library & Information Science Research*, 25(4), 459-476.

Landau, R., & Rosenberg, N. (Eds.). (1986). *The positive sum strategy: Harnessing technology for economic growth*. Washington, D.C.: National Academy Press.

Larson, J. R., & Christensen, C. (1993). Groups as problem solving units: Toward a new meaning of social cognition. *British Journal of Social Psychology,* 32, 5-30.

Laughlin, P. R., & Ellis, A. L. (1986). Demonstrability and social combination processes on mathematical intellective tasks. *Journal of Experimental Social Psychology,* 22, 177-189.

Laughlin, P. R., VanderStoep, S. W., & Hollingshead, A. B. (1991). Collective versus individual induction: Recognition of truth, rejection of error, and collective information processing. *Journal of Personality and Social Psychology*, 61, 50-67.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Lawler, E. E., Mohrman, S. A., & Ledford, G. E. (1992). *Employee involvement and total quality management.* San Francisco: Jossey-Bass.

Leckie, G. J. (2005). General model of the information-seeking of professionals. In K. E. Fisher, S. Erdelez, & L. McKechnie (Eds.), *Theories of information behavior* (Chapter 25, pp. 158-159). Medford, N.J.: Information Today.

Leckie, G. J., & Pettigrew, K. E. (1997). A general model of the information-seeking of professionals: Role theory through the back door? In P. Vakkari, R. Savolainen, & B. Dervin (Eds.), *Information-seeking in context* (pp. 99-110). London, UK: Taylor Graham.

Leckie, G. J., Pettigrew, K. E., & Sylvain, C. (1996). Modeling the information-seeking of professionals: a general model derived from research on engineers, health care professionals and lawyers. *Library Quarterly*, 66(2), 162-193.

Leinhardt, G., Young, K. M., & Merriman, J. (1995). Integrating professional knowledge: The theory of practice and the practice of theory. *Learning and Instruction*, 5(4), 401-408.

Levine, J. M., Resnick, L. B., & Higgins, E. T. (1993). Social foundations of cognition. *Annual Review of Psychology*, 44, 585-612.

Lewis, K. (2003). Measuring transactive memory sytems in the field: Scale development and validation. *Journal of Applied Psychology*, 88(4), 587-604.

Liang, D. W., Moreland, R., & Argote, L. (1995). Group versus individual training and group performance: The mediating role of transactive memory. *Personality and Social Psychology Bulletin*, 21, 384-393.

Lin, N., & Garvey, W. D. (1972). Information needs and uses. In C. A. Cuadra & A. W. Luke (Eds.), *Annual review of information science and technology* (Vol. 7, pp. 5-37). Washington, DC: American Society for Information Science.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park, CA: Sage Publications.

Linstrom, J. (2006, October). As decades change, so does teaching. *Fire Chief*, 50(10), 30-33.

Lipetz, B. A. (1970). Information needs and uses. In C. A. Cuadra & A. W. Luke (Eds.), *Annual review of information science and technology* (Vol. 5, pp. 3-32). Chicago, IL: Encyclopedia Britannica.

Littlepage, G., Robinson, W., & Reddington, K. (1997). Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organizational Behavior and Human Decision Processes*, 69(2), 133-147.

Litwak, E. (1961). Models of organization which permit conflict. *American Journal of Sociology*, 67, 177-184.

Lloyd, A. (2007). Learning to put out the red stuff: Becoming information literate through discursive practice. *Library Quarterly*, 77(2), 181-198.

Lofland, J., & Lofland, L. H. (1994). *Analyzing social setting*. (3rd ed.). Belmont, CA: Wadsworth Publishing Company.

Louis, M. R. (1980). Surprise and sense making: What newcomers experience in entering unfamiliar organizational settings. *Administrative Science Quarterly*, 25, 226-251.

Mackenzie, M. L. (2002). Information gathering: The information behaviors of line-managers within a business environment. In E. G. Toms (Ed.), *ASIST 2002: Information, Connections and Community. Proceedings of the ASIST Annual Meeting (65th, Philadelphia, November 18-21, 2002)* (pp. 164-170). Medford, NJ: Information Today, Inc.

Mackenzie, M. L. (2003a, Summer). An exploratory study investigating the information behavior of line managers within a business environment. *New Review of Information Behaviour Research*, 4(1), 63-78.

Mackenzie, M. L. (2003b). Information gathering revealed within the social network of line-managers. In M. J. Bates & R. Todd (Eds.), *ASIST 2003, Humanizing information technology: from ideas to bits and back (66th, Long Beach, CA, October 19-22, 2003)*, (Vol. 40, pp. 85-94). Medford, NJ: Information Today.

Mackenzie, M. L. (2004). The cultural influences of information flow at work: Manager information behavior documented. In L. Schamber & C. Barry (Eds.), *ASIST 2004: proceedings of the 67th ASIS & T Annual Meeting: Managing and enhancing information: culture and conflicts (67th, Providence, RI, November 12-17, 2004)* (Vol. 41, pp. 184-190). Medford, NJ: Information Today.

Mackenzie, M. L. (2005). Managers look to the social network to seek information. *Information Research*, 10(2). Retrieved from http://informationr.net/ir/10-2/paper216.html

Mailloux, E. N. (1989). Engineering information systems. In M. E. Williams (Ed.), *Annual review of information science and technology* (Vol. 24, pp. 239-268). Medford, N.J.: Learned Information.

Malek-Mohammadi, I. (2000). *An investigation of current information system in the Ministry of Jihad-e-Sazandegi.* Tehran, Iran: Ministry of Jihad-e Sazandegi.

Malmgren, R. D., Ottino, J. M., & Amaral, L. A. N. (2010). The role of mentorship in protégé performance, *Nature*, 465, 622-626.

Manning, W. A. (2002, February). A new culture of responsibility. *Fire Engineering*, 155(2), 4.

Manz, C. C., & Sims, H. P. (1993). *Business without bosses: How self-managing teams are building high-performance companies.* New York: Wiley.

Marchionini, G. (1995). *Information-seeking in electronic environments*. New York: Cambridge University Press.

Marquis, D. G., & Allen, T. J. (1966). Communication patterns in applied technology. *American Psychologist*, 21, 1052-1060.

Marshall, J. (1993). Issues in clinical information delivery. *Library Trends*, 42, 83-107.

Martin, S. B. (1998). Information technology, employment and the information sector: Trends in information employment 1970-1995. *Journal of the American Society for Information Science*, 49, 1053-1069.

Martyn, J. (1974). Information needs and uses. In C. A. Cuadra (Ed.), *Annual review of information science and technology* (Vol. 9, pp. 3-23). Washington, DC: American Society for Information Science.

Mayer, M. (1966). *The lawyers*. New York: Harper & Row.

McDonald, D. W., & Ackerman, M. S. (1998). Just talk to me: A field study of expertise location. In *Proc. ACM Conf. Computer Supported Cooperative Work (CSCW'98)* (pp. 315-324). New York: ACM.

McGee, J. E., & Sawyer, O. (2003). Uncertainty and information search activities: A study of owner-managers of small high-technology manufacturing firms. *Journal of Small Business Management,* 41(4), 385-401.

McGrath, J. E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice-Hall.

McGrath, J. E., & Arrow, H. (1995-1996). Introduction: the JEMCO-2 study of time, technology, and groups. *Computer Supported Cooperative Work*, 4(2/3), 107-126.

McGrath, J. E., & Hollingshead, A. B. (1994). *Groups interacting with technology*. Thousand Oaks, CA: Sage.

McKeever, L. P. (1997). Radio procedures: a practical guide for fire departments. *Firehouse,* 22(2), 36-38.

Meadows, A. J. (1998). *Communicating research.* San Diego, CA: Academic Press.

Meehan, A. J. (2000). Transformation of the oral tradition of the police subculture through the introduction of information technology. *Sociology of Crime, Law and Deviance*, 2, 107-132.

Meister, G. (1997.) Between 800MHz and a hard place. *Fire Chief,* 41(6), 50-52.

Meister, G. (1998). Will today's radios fit into tomorrow's world. *Fire Chief*, 42(10), 54-57.

Melgoza, P., Mennel, P. A., & Gyeszly, S. D. (2002). Information overload. *Collection Building*, 21(1), 32-42.

Menzel, H. (1966). Information needs and uses in science and technology. In C. A. Cuadra (Ed.), *Annual review of information science and technology* (Vol. 1, pp. 40-69). New York: John Wiley & Sons.

Messer-Davidow, E. (1993). Disciplinary ways of knowing. In E. Messer-Davidow, D. R. Shumway, & D. J. Sylvan (Eds.), *Knowledges: Historical and critical studies in disciplinarity* (pp. 1-21). Charlottesville: University Press of Virginia.

Metoyer-Duran, C. (1993). Information gatekeepers. In M. E. Williams (Ed.), *Annual review of information science and technology* (Vol. 28, pp. 111-150). Medford, NJ: Learned Information.

Michinov, E., Olivier-Chiron, E., Rusch, E., & Chiron, B. (2008). Influence of transactive memory on perceived performance, job satisfaction and identification in anaesthesia teams. *British Journal of Anaesthesia*, 100(3), 327-332.

Mick, C. K., Lindsey, G. N., & Callahan, D. (1980). Toward usable user studies. *Journal of the American Society for Information Science*, 31(5), 347-356.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: an expanded sourcebook* (2nd ed.). Thousand Oaks: Sage Publications.

Miller, V. D., & Jablin, F. M. (1991). Information-seeking during organizational entry: Influence, tactics, and a model of the process. *Academy of Management Review*, 16, 92-120.

Mishler, E. G. (1986). *Research interviewing context and narrative*. Cambridge, MA: Harvard University Press.

Mohammadi, D. (2002). An investigation of the factors influencing information-seeking behavior of extension workers in Zanjan province of Iran. Unpublished Master's thesis, Tehran University, Tehran, Iran.

Monigold, G. E. (1993). *Administrative study of state fire training and education programs*. (2nd ed.). Champaign, IL: Illinois Fire Service Institute, University of Illinois at Urbana-Champaign.

Moreland, R. L. (1999). Transactive memory: Learning who knows what in work groups and organizations. In L. L. Thompson, J. M. Levine, & D. M. Messick (Eds.), *Shared cognition in organizations: The management of knowledge* (pp. 3-31). Mahwah, NJ: Erlbaum.

Moreland, R. L., Argote, L., & Krishnan, R. (1996). Socially shared cognition at work: Transactive memory and group performance. In J. L. Nye & A. M. Brower (Eds.), *What's social about social cognition?* (pp. 57-84). Thousand Oaks, CA: Sage.

Moreland, R. L., & Levine, J. M. (1992). Problem identification by groups. In S. Worchel, W. Wood, & J. A. Simpson (Eds.), *Group process and productivity* (pp. 17-47). Newbury Park, CA: Sage.

Moreland, R. L., & Myaskovsky, L. (2000). Exploring the performance benefits of group training: Transactive memory or improved communication? *Organizational Behavior and Human Decision Processes*, 82, 117-133.

Morrison, E. W. (1993a). A longitudinal study of the effects of information-seeking on newcomer socialization. *Journal of Applied Psychology*, 78, 173-183.

Morrison, E. W. (1993b). Newcomer information-seeking: Exploring types, modes, sources and outcomes. *Academy of Management Journal*, 36, 557-589.

Morrison, E. W. (2002). Information-seeking within organizations. *Human Communication Research*, 28(2), 229-242.

Morrison, E. W., & Cummings, L. L. (1992). The impact of diagnosticity and performance expectations on feedback seeking behavior. *Human Performance*, 5, 251-264.

Morrison, E. W., & Vancouver, J. B. (2000). Within-person analysis of information-seeking: The effects of perceived costs and benefits. *Journal of Management*, 26(1), 119-137.

Morrison, E. W., & Weldon, E. (1990). The impact of an assigned performance goal on feedback seeking behavior. *Human Performance*, 3, 37-50.

Murnighan, J. K., & Conlon, D. E. (1991). The dynamics of intense work groups: A study of British string quartets. *Administrative Science Quarterly*, 36, 165-186.

National Academy of Sciences - National Research Council, Washington, DC. Commission on Engineering and Technical Systems. (1985). *Engineering employment characteristics. Engineering education and practice in the United States.* Washington, D.C.: National Academy Press.

National Fire Academy. (2000). *Introduction to command and general staff.* Retrieved from http://www.ct.gov/cfpc/lib/cfpc/ICGS_Unit_1.pdf

National Fire Protection Association. (2003). *Fire protection handbook.* (19th ed.). Quincy, MA: National Fire Protection Association.

National Institute for Occupational Safety and Health. (2002). *Death in the line of duty: A summary of a NIOSH fire fighter fatality investigation.* Morgantown, West Virginia: National Institute for Occupational Safety and Health.

National Institute for Occupational Safety and Health. (2010). *Fire Fighter Suffers Probable Fatal Cardiac Arrhythmia During On-Duty Mandatory Physical Fitness Training, North Carolina*. Death in the line of duty. Cincinnati, Ohio: National Institute for Occupational Safety and Health.

Neale, M. A., Bazerman, M. H., Northcraft, G. B., & Alperson, C. (1986). “Choice shift” effects in group decisions: A decision bias perspective. *International Journal of Small Group Research*, 2, 33-42.

Nelson, C. E., & Pollock, D. K. (Eds.). (1970). *Communication among scientists and engineers*. Lexington, MA: Heath.

Niedzwiedzka, B. (2003). A proposed general model of information behavior. *Information Research*, 9(1), paper 164. Retrieved from http://Informationr.net/ir/9-1/paper164.html

Nilan, M. S., Peek, R. P., & Snyder, H. W. (1988). A methodology for tapping user evaluation behaviors. An exploration of users’ strategy, source and information evaluating. In C. L. Borgman & E. Y. H. Pai (Eds.), *Proceedings of the 51st Annual Meeting of the American Society for Information Science, October 23-27, 1988* (pp. 152-159). Medford, NJ: Learned Information.

Nkereuwem, E. E. (1984). *An analysis of information use by scientists and engineers in the petroleum industry in Nigeria.* Doctoral dissertation, University of Michigan at Ann Arbor.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. New York: Oxford University Press.

Norling, E., & Heinze, C. (2000). Naturalistic decision making and agent-oriented cognitive modeling: A preliminary study. In *5th Conference of the Australasian Cognitive Science Society.* Melbourne, 2000.

Norman, J. (1994, November). Fireground tactics: Engine company tactics. *Firehouse*, 19(11), 16-17.

Ocheibi, J. A., & Buba, A. (2003). Information needs and information gathering behavior of medical doctors in Maiduguri, Nigeria. *Journal of Educational Media & Library Sciences*, 40(4), 417-427.

O'Day, V. L., & Jeffries, R. (1993, November). Information artisans: Patterns of result sharing by information searchers. Paper presented at the Conference on Supporting Group Work, Milpitas, CA.

Onieal, D. (2003a). Professional status: the future of fire service training and education, part 1. *FireHouse*, [27], 82-85.

Onieal, D. (2003b). Professional status: the future of fire service training and education, part 2. *FireHouse*, [28], 92-97.

Onieal, D. (2003c). Professional status: the future of fire service training and education, part 3. *FireHouse*, [29], 80-84.

Onieal, D. (2003d). Professional status: the future of fire service training and education, part 4. *FireHouse*, [30], 90-92.

Orasanu, J., & Salas, E. (1993). Team decision making in complex environments. In G. Klein, J. Orasanu, R. Calderwood, & C. Zsambok (Eds.), *Decision-making in action: Models and methods* (pp. 327-345). Norwood, NJ: Ablex.

O'Reilly, C., III. (1982). Variations in decision makers' use of information sources: The impact of quality and accessibility of information. *Academy of Management Journal*, 25(4), 756-771.

Orr, J. E. (1990). Sharing knowledge, celebrating identity: Community memory in a service culture. In D.S. Middleton & D. Edwards (Eds.), *Collective remembering* (pp. 169-189). London: Sage.

Orr, R. (1970). The scientist as an information processor: A conceptual model illustrated with data on variables related to library utilization. In C. E. Nelson & D. K. Pollock (Eds.), *Communication among scientists and engineers* (pp. 143-189). Lexington, MA: D.C. Heath.

Orr, T. B. (2003). Heroes of the flames: Firefighters: Firefighters are every day heroes, putting their lives on the line. Here's what it takes to be one. *Career World*, 32(3), 14. Retrieved from http://findarticles.com/p/articles/mi_m0HUV/is_3_32/ai_110114701

Osheroff, J. A., Forsythe, D. E., Buchanan, B. G., Bankowitz, R. A., Blumenfeld, B. H., & Miller, R. A. (1991). Physicians' information needs: An analysis of questions posed during clinical teaching. *Annals of Internal Medicine*, 114, 576-581.

Otike, J. (1999). The information needs and seeking habits of lawyers in England: A pilot study. *International Information & Library Review*, 31, 19-39.

Paepcke, A. (1996). Information needs in technical work setting and their implications for the design of computer tools. *Computer Supported Cooperative Work*: *The Journal of Collaborative Computing*, 5(1), 63-92.

Paisley, W. J. (1968). Information needs and uses. In C. Cuadra (Ed.), *Annual review of information science and technology* (Vol. 3, pp. 1-30). Chicago: Encyclopedia Britannica.

Palmer, C. L. (1996). *Practices and conditions of boundary crossing research work: A study of scientists at an interdisciplinary institute*. PhD Dissertation, University of Illinois at Urbana-Champaign, United States.

Parnas, D. L., & Clements, P. C. (1986). A rational design process: How and why to fake it. *IEEE Transactions on Software Engineering, SE,* 12(2), 251-257.

Patton, M. Q. (1990). *Qualitative evaluation and research methods.* (2nd ed.). Newbury Park, CA: Sage Publications.

Pennebaker, J. W. (1982). *The psychology of physical symptoms*. New York: Springer-Verlag.

Perrow, C. (1967). A framework for the comparative analysis of organizations. *American Sociological Review*, 32(2), 194-208.

Pettigrew, K. E., Fidel, R., & Bruce, H. (2001). Conceptual frameworks in information behavior. In M. E. Williams (Ed.), *Annual review of information science and technology* (Vol. 35, pp. 43-78). Medford, NJ: Information Today.

Pezeshki-Rad, G. & Zamani, N. (2005). Information-seeking behavior of Iranian extension managers and specialists. *Information Research*, 10(3), Retrieved from http://informationr.net/ir/10-3/paper229.html

Pierce, S. J. (1987). Characteristics of professional knowledge structure. *Library & Information Science Research*, 9, 143-171.

Pinelli, T. E. (1991). The information-seeking habits and practices of engineers. *Science & Technology Libraries*, 11(3), 5-25.

Pinelli, T. E., Bishop, A. P., Barclay, R. O., & Kenney, J. M. (1993). The information-seeking behavior of engineers. *Encyclopedia of Library and Information Science,* 52 (Suppl. 15), 167-201.

Poland, J. (1991). Informal communication among scientists and engineers: A review of the literature. *Science & Technology Libraries*, 11(3), 61-73.

Polanyi, M. (1967). *The tacit dimension.* New York: Anchor Books.

Polanyi, M. (1998*). Personal knowledge: Towards a post-critical philosophy*. London: Routledge.

Poltrock, S., Fidel, R., Bruce, H., Grudin, J., Dumais, S., & Pejtersen, A. M. (2003a). A comparison of the collaborative information retrieval behaviour of two design teams. *New Review of Information Behaviour Research*, 4(1), 139-153.

Poltrock, S., Fidel, R., Bruce, H., Grudin, J., Dumais, S., & Pejtersen, A. M. (2003b). Information-seeking and sharing in design teams. In M. Pendergast (Ed.), *Group '03: Proceedings of the 2003 International ACM SIGGROUP Conference on Supporting Group Work: November 9-12, 2003, Sundial Resort on Sanibel Island, Florida, USA* (pp. 239-247). New York, N.Y.: Association for Computing Machinery.

Pompper, D., & Adams, J. (2006). Under the microscope: Gender and mentor-protégé relationships. *Public Relations Review,* 32, 309-315.

Poole, M. S. (1999). Group communication theory. In L. R. Frey, M. S. Poole, & D. S. Gouran (Eds.), *The Handbook of group communication theory and research* (pp. 37-70). Thousand Oaks, CA: Sage.

Poole, M. S., & Doelger, J. A. (1986). Developmental processes in group decision-making. In R.Y. Hirokawa & M. S. Poole (Eds.), *Communication and group decision making* (pp. 35-61). Newbury Park, CA: Sage.

Poole, M. S., Seibold, D. R., & McPhee, R. D. (1986). A structurational approach to theory building in group decision-making research. In R. Hirokawa & M. S. Poole (Eds.), *Communication and group decision making* (pp. 237-264). Newbury Park, CA: Sage.

Prekop, P. (2002). A qualitative study of collaborative information-seeking. *Journal of Documentation*, 58(5), 533-547.

Prentice, A. (1980). Information-seeking patterns of selected professionals. *Public Library Quarterly,* 2, 27-62.

Pressler, B. (1994, April). "Bread and butter" operations: Multiple dwellings, part 2-engine company operations. *Fire Engineering*, 147(4), 69-72.

Pressler, B. (1999, March). Engine company operations. *Fire Engineering*, 152(3), 22-28.
Price, D. J. S. (1963). *Little science, big science*. New York: Columbia University Press.

Price, D. J. S. (1965). Networks of scientific papers. *Science,* 149, 510-515.

Radecki, C. M., & Jaccard, J. (1995). Perceptions of knowledge, actual knowledge, and information search behavior. *Journal of Experimental Social Psychology*, 31, 107-138.

Raitt, D. I. (1988). The information needs of scientists and engineers in aerospace. In *The Value of Information as an integral part of aerospace and defence R&D Programmes* (pp. 3.1-3.5). Cheltenham, UK: Agard.

Reddy, M. C., & Dourish, P. (2002, November). A finger on the pulse: Temporal rhythms and information-seeking in medical work. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work* (pp. 344-353). New York, New York: ACM Press.

Reddy, M. C., & Jansen, B. J. (2008). A model for understanding collaborative information behavior in context: A study of two health care teams. *Information Processing & Management*, 44(1), 256-273.

Reddy, M. C., & Spence, P. R. (2008). Collaborative information-seeking: A field study of a multidisciplinary patient care team. *Information Processing & Management*, 44(1), 242-255.

Rogers, E., & Cooper, W. (1979). Survey of professional attitudes toward research retrieval systems. *Law Library Journal*, 72, 130-143.

Rogers, E., & Shoemaker, F. F. (1971). *Communication of innovations: A cross-cultural approach*. New York: Free Press.

Romano, N. C., Roussinov, D., Nunamaker, J. F., & Chen, H. (1999, January). *Collaborative information retrieval environment: integration of information retrieval with group support systems.* Paper presented at the Thirty-Second Annual Hawaii International Conference on System Sciences, Hawaii, HI.

Rosenberg, V. (1967). Factors affecting the preferences of industrial personnel for information gathering methods. *Information Storage and Retrieval*, 3, 119-127.

Rosenbloom, R. S., & Wolek, F. W. (1967). *Technology, information and organization: Information transfer in industrial R&D*. Boston: Harvard University, Graduate School of Business Administration.

Ruan, L. (2001). Providing better subject access to non-print fire emergency materials for Illinois firefighters. *Cataloging & Classification Quarterly*, 31(3/4), 213-235.

Ruan, L., & Smith, L. C. (2003). A survey to support 'evidence-based practice' in special libraries serving fire service personnel and researchers in public safety and homeland security areas, a full report. Retrieved from http://www.sla.org/content/learn/scholarship/goldspiel/goldspiel2003.cfm

Ruan, L., & Smith, L. C. (2007). Evidence-based practice in U.S. fire library management. *The Evidence Based Library and Information Practice Conference (EBLIP4) Proceedings, May 6-9, 2007 in Chapel Hill, North Carolina*. Retrieved from http://www.eblip4.unc.edu

Rubin, H. J., & Rubin, I. S. (2005). *Qualitative interviewing, the art of hearing data*. Thousand Oaks: Sage Publications.

Russell, J. M. (2001). Scientific communication at the beginning of the twenty-first century. *International Social Science Journal*, 168, 271-282.

Ryle, G. (1949). *The concept of mind.* London: Hutchinson University Library.

Saavedra, R., Earley, P. C., & Van Dyne, L. (1993). Complex interdependence in task performing groups. *Journal of Applied Psychology*, 78, 61-72.

Sackett, D. L., & Snow, J. C. (1979). The magnitude of compliance and non-compliance. In R. B. Haynes, D. W. Taylor, & D. L. Sackett (Eds.), *Compliance in health care* (pp. 11-22). Baltimore, MD: Johns Hopkins University Press.

Salas, E., Dickenson, T. L., Converse, S. A., & Tannenbaum, S. I. (1992). Toward an understanding of team performance and training. In R. J. Swezey & E. Salas (Eds.), *Teams: Their training and performance* (pp. 3-29). Norwood, NJ: Ablex.

Salas, E., Sims, D. E., & Burke, C. S. (2005). Is there a “big five” in teamwork? *Small Group Research*, 36(5), 555-599.

Salka, J., & Neville, B. (2004). *First in, last out: leadership lessons from the New York Fire Department*. New York: Portfolio.

Savolainen, R. (1995). Everyday life information-seeking: Approaching information-seeking in the context of "way of life". *Library & Information Science Research*, 17(3), 259-294.

Savolainen, R. (2008). *Everyday information practices: a social phenomenological perspective.* Lanham, Md.: Scarecrow Press, 2008.

Schön, D. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Schrage, D. (2007). Officer mentoring preserves fire service heritage. *Fire Engineering*, 160(1), 83-86.

Schulman, L. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22.

Schwartz, D., & Jacobson, E. (1977). Organizational communication network analysis: The liaison role. *Organizational Behavior and Human Performance*, 18, 158-174.

Seidman, I. E. (1991). *Interviewing as qualitative research: A guide for researchers in education and the social sciences.* New York and London: Teachers College Press.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.

Shapiro, P. (2004, April). Blitz-line deployment, handling a 500-gpm handline with minimum manpower. *FireRescue Magazine*, 22(4), 59-70.

Shearing, C., & Ericson, R. (1991). Culture as figurative action. *British Journal of Sociology*, 42(4), 481-506.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22(2), 63-75.

Shih, W. Y., & Evans, J. F. (1991). Where field staff get information. *Journal of Extension*, 29(3). Retrieved from http://www.joe.org/joe/1991fall/a5.php

Shoemaker, P. J. (1991). *Gatekeeping*. Newbury Park, CA: Sage.

Shoemaker, P. J., Eichholz, M., Kim, E., & Wrigley, B. (2001). Individual and routine forces in gatekeeping. *Journalism and Mass Communication Quarterly*, 78(2), 233-246.

Shuchman, H. L. (1981). *Information transfer in engineering*. Glastonbury, CT: The Futures Group.

Shuchman, H. L. (1982). Information technology and the technologist: A report on a national study of American engineers. *International Forum on Information and Documentation*, 7(1), 3-8.

Simon, H. (1992). Decision making and problem solving. In M. Zey (Ed.), *Decision making: Alternatives to rational choice models* (pp. 32-53). Newbury Park, CA: Sage Publications.

Simpson, E. (1966). *Classification of educational objectives, psychomotor domain*. Urbana, IL: University of Illinois at Urbana-Champaign.

Sitz, T. (2005, February). The engine company. Team building drills for the engine company. *Fire Engineering*, 158(2), 26+.

Smeby, L. C. (2006). *Fire and emergency services administration, management and leadership practices*. Sudbury, MA: Jones and Bartlett Publishers.

Smith, D. L., Horn, G., Goldstein, E., & Petruzzello, S. (2008). *Firefighter fatalities and injuries: the role of heat stress and PPE. Firefighter*. Urbana, IL: Life Safety Research Center, Illinois Fire Service Institute, University of Illinois.

Sniezek, J. A. (1992). Groups under uncertainty: An examination of confidence in group decision making. *Organizational Behavior and Human Decision Processes*, 52, 124-155.

Solomon, P. (1997). Information behavior in sense making: A three-year case study of work planning. In P. Vakkari, R. Savolainen, & B. Dervin (Eds.), *Information-seeking in context* (pp. 290-306). London: Taylor Graham.

Sonnenwald, D. H. (1995). Contested collaboration: a descriptive model of intergroup communication and information system design. *Information Processing & Management*, 31(6), 859-879.

Sonnenwald, D. H., & Lievrouw, L. A. (1997). Collaboration during the design process: A case study of communication, information behavior and project performance. In P. Vakkari, R. Savolainen, & B. Dervin (Eds.), *Information-seeking in context: Proceedings of an international conference on research in information needs, seeking and use in different contexts, 14-16 August, Tampere, Finland* (pp. 179-204). London: Taylor Graham.

Sonnenwald, D. H., & Pierce, L. G. (2000). Information behavior in dynamic group work contexts: interwoven situational awareness, dense social networks and contested collaboration in command and control. *Information Processing & Management*, 36(3), 461-479.

Soper, M. E. (1976). Characteristics and use of personal collections. *Library Quarterly*, 46(4), 397-415.

Special Libraries Association. (2001). *Putting OUR Knowledge to Work: A New SLA Research Statement June 2001 The Role of Research in Special Librarianship.* Retrieved from http://www.sla.org/content/resources/research/rsrchstatement.cfm

Stasser, G., Kerr, N. L., & Davis, J. H. (1989). Influence processes and consensus models in decision-making groups. In P. B. Paulus (Ed.), *Psychology of group influence* (2nd ed., pp. 279-326). Hillsdale, NJ: Lawrence Erlbaum.

Stasser, G., Stewart, D. D., & Wittenbaum, G. M. (1995). Expert roles and information exchange during discussion: The importance of knowing who knows what. *Journal of Experimental Social Psychology*, 31, 244-265.

Stefl-Mabry, J. (2005). The reality of media preferences: Do professional groups vary in awareness? *Journal of the American Society for Information Science and Technology*, 56(13), 1419-1426.

Stein, A., & Maier, E. (1994). Structuring collaborative information-seeking dialogues. *Knowledge-based Systems*, 8(2-3), 82-93.

Stewart, D. D., & Stasser, G. (1995). Expert role assignment and information sampling during collective recall and decision making. *Journal of Personality and Social Psychology*, 69, 619-628.

Stogdill, R. M. (1959). *Individual behavior and group achievement*. New York: Oxford University.

Strauss, A. L. (1987). *Qualitative analysis for social scientists*. Cambridge: Cambridge University Press.

Strauss, A. L., & Corbin, J. M. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* (2nd ed.). Thousands Oaks, CA: Sage Publications.

Streufert, S., & Nogami, G. (1992). Cognitive complexity and team decision making. In R. W. Swezey & E. Salas (Eds.), *Teams: Their training and performance* (pp. 127-151). Norwood, NJ: Ablex.

Sturtevant, T. B. (2001). *A study of undergraduate fire service degree programs in the United States*. Doctoral dissertation, University of Tennessee. Retrieved from http://www.dissertation.com

Sundquist, J. (1978). Research brokerage: The weak link. *The Brookings Institute Report*, 342, 10-20. Washington, D. C.: Brookings Institution.

Sutton, S. (1994). The role of attorney mental models of law in case relevance determinations: An exploratory analysis. *Journal of the American Society for Information Science,* 45, 186-200.

Swanson, E. B. (1987). Information channel disposition and use. *Decision Science*, 18, 131-145.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes,* 82(1), 9-27.

Tackie, S. N. B., & Adams, M. (2007). Information needs and seeking behavior of engineers in Ghana: A case study of the Volta River Authority. *African Journal of Library, Archives and Information Science,* 17(2) , 69-78.

Talja, S. (2002). Information sharing in academic communities: Types and levels of collaboration in information-seeking and use. *New Review of Information Behavior Research,* 3, 143-160.

Talja, S., & Hansen, P. (2006). Information sharing. In A. Spink & C. Cole (Eds.), *New directions in human information behavior* (pp. 113-134). Dordrecht, Netherlands: Springer.

Talja, S., Keso, H., & Pietilaninen, T. (1999). The production of “context” in information-seeking research: A metatheoretical view. *Information Processing & Management*, 35(6), 751-763.

Talja, S., Tuominen, K., & Savolainen, R. (2005). "Isms" in information science: constructivism, collectivism and constructionism. *Journal of Documentation*, 61(1), 79-101.

Taylor, R. S. (1986). *Value added processes in information systems*. Norwood, NJ: Ablex.

Taylor, R. S. (1991). Information use environments. In B. Dervin & M.J. Voigt (Eds.), *Progress in Communication Sciences* (Vol. 10, pp. 217-255). Norwood, NJ: Ablex.

Tenopir, C., & King, D. W. (2004). *Communication patterns of engineers*. New York: Wiley Interscience.

Thiel, A. (1999). *Improving firefighter communications: Special report*. Washington, DC: United States Fire Administration.

Tiamiyu, M. A. (1992). The relationships between source use and work complexity, decision-maker discretion and activity duration in Nigerian government ministers. *International Journal of Information Management*, 12, 130-141.

Tillema, H. H. (1995). Changing the professional knowledge and beliefs of teachers: A training study. *Learning and Instruction*, 5(4), 291-318.

Timpka, T., & Arborelius, E. (1990). The GP's dilemmas: A study of knowledge need and use during health care consultations. *Methods of Information in Medicine*, 29, 23-29.

Tindale, R. S. (1989). Group vs individual information processing: The effects of outcome feedback on decision making. *Organizational Behavior and Human Decision Processes*, 44, 454-473.

Trope, Y. (1975). Seeking information about one's ability as determinant of choice among tasks. *Journal of Personality and Social Psychology*, 32, 1004-1013.

Tuominen, K., Talja, S., & Savolainen, R. (2002). Discourse, cognition, and reality: Toward a social constructionist metatheory for library and information science. *Proceedings of the Fourth International Conference on Concepts of Library and Information Science, United States* (pp. 271-283).

Turner, D. (2007). Conceptualizing oral documents. Proceedings of the Sixth International Conference on Conceptions of Library and Information Science – "Featuring the Future". *Information Research*, 12(4). Retrieved from http://informationr.net/ir/12-4/colis/colis32.html

Turner, D. (2009). *Conceptualizing oral documents*. PhD Dissertation, University of Washington, Seattle, United States.

Tushman, M. L. (1978). Technical communication in R&D laboratories: The impact of project work characteristics. *Academy of Management Journal*, 21(4), 624-645.

Tushman, M. L., & Katz, R. (1980). External communication and project performance: An investigation into the role of gatekeepers. *Management Science*, 26(11), 1071-1084.

Tushman, M. L., & Scanlan, T. J. (1981a). Characteristics and external orientations of boundary spanning individuals. *Academy of Management Journal*, 24(1), 83-98.

Tushman, M. L., & Scanlan, T. J. (1981b). Boundary spanning individuals: Their role in information transfer and their antecedents. *Academy of Management Journal*, 24(2), 289-305.

Twidale, M. B., & Nichols, D. M. (1998). Designing interfaces to support collaboration in information retrieval. *Interacting with Computers*, 10(2), 177-193.

Twidale, M. B., Nichols, D. M., & Paice, C. D. (1997). Browsing is a collaborative process. *Information Processing & Management*, 33(6), 761-783.

Ullman, D. G. (1992). *The mechanical design process*. New York: McGraw-Hill.

United States Fire Administration. (2002). *Firefighter fatality retrospective study*. Washington, D.C.

United States Fire Administration, & National Fire Protection Association. (2002). *A needs assessment of the U.S. fire service: a cooperative study authorized by U.S. Public Law 106-398*. [Washington, D.C.]: FEMA, U.S. Fire Administration, NFPA International.

United States Fire Administration, & TriData Corporation. (2002). *Firefighter fatality retrospective study*. [Emmitsburg, Md.]: FEMA.

United States Fire Administration, Department of Homeland Security, & Federal Emergency Management Agency. (2008). *Firefighter fatalities in the United States in 2008*. [Emmitsburg, Md.]

United States. National Commission on Fire Prevention and Control. (1973). *America burning: The report of the National Commission on Fire Prevention and Control.* Washington, D.C.: U.S. Government Printing Office. Retrieved from http://www.usfa.fema.gov/downloads/pdf/publications/fa-264.pdf

United States. National Fire Prevention and Control Administration. (1975). *Report on a survey of the fire education and training programs (within the United States and its territorial possessions) and appendices*. [Washington, D.C.]: National Fire Prevention and Control Administration.

Urquhart, C. (1998). Personal knowledge: A clinical perspective from the Value and EVINCE projects in health library and information services. *Journal of Documentation*, 54(4), 420-442.

Urquhart, C. (1999). Using vignettes to diagnose information-seeking strategies: Opportunities and possible problems for information use studies of health professionals. In T. D. Wilson & D. K. Allen (Eds.), *Information behaviour: Proceedings of the second international conference on research in information needs, seeking and use in different contexts, 13/15 August 1998, Sheffield, UK* (pp. 277-289). London: Taylor Graham.

Vakkari, P. (2003). Task-based information searching. In B. Cronin (Ed.), *Annual Review of Information Science and Technology* (Vol. 37, pp. 413-464.). Medford, NJ: Information Today.

Vakkari, P., & Kuokkanen, M. (1997). Theory growth in information science: Applications of the theory of science to a theory of information-seeking. *Journal of Documentation*, 53(4), 497-519.

Vale, M. (1988). *Information structure and information-seeking behavior of lawyers.* Unpublished doctoral dissertation, Stanford University, Stanford, CA.

Van House, N.A. (2004). Science and technology studies and information studies. *Annual Review of Information Science and Technology*, 38, 1-86.

Vancouver, J. B., & Morrison, E. W. (1995). Feedback inquiry: The effect of source attributes and individual difference. *Organizational Behavior and Human Decision Processes*, 62(3), 276-285.

VandeWalle, D., Genesan, S., Challagalla, G. N., & Bron, S. P. (2000). An integrated model of feedback-seeking behavior: Disposition, context, and cognition. *Journal of Applied Psychology*, 85, 996-1003.

Vansina, J. (1985). *Oral tradition as history*. Madison, WI: University of Wisconsin Press.

Varone, J. C. (2003). Firefighter safety and radio communication. *Fire Engineering*, 156(3), 141-164.

Veinot, T. C. (2009). Interactive acquisition and sharing: Understanding the dynamics of HIV/AIDS information network. *Journal of the American Society for Information Science and Technology*, 60(11), 2313-2332.

Vezeau, T. (1993). Storytelling: A practitioners tool. *American Journal of Maternal Child Nursing*, 18(4), 193-196.

Vickery, B., & Vickery, A. (1989). *Information science in theory and practice*. London: Butterworths.

Vincenti, W. G. (1990). *What engineers know and how they know it: Analytical studies from aeronautical history*. Baltimore: Johns Hopkins University.

Vollrath, D. A., Sheppard, B. H., Hinsz, V. B., & Davis, J. H. (1989). Memory performance by decision-making groups and individuals. *Organizational Behavior and Human Decision Processes*, 43, 289-300.

Von Cranach, M., Ochsenbein, G., & Valach, L. (1986). The group as a self-active system: Outline of a theory of group action. *European Journal of Social Psychology*, 16, 193-229.

Von Seggern, M., & Jourdain, J. M. (1996). Technical communications in engineering and science: The practices within a government defense laboratory. *Special Libraries*, 87(2), 98-119.

Wall, T. D., Kemp, N. J., Jackson, P. R., & Clegg, C. W. (1986, June). Outcomes of autonomous work groups: a long-term field experiment. *The Academy of Management Journal*, 29(2), 280-304.

Wallington, N. (2003). *The world of fire engines & firefighting: fire and rescue – an illustrated guide to fire trucks around the world, with 700 pictures of modern and historical appliances.* London: Lorenz.

Walsh, J. P., Henderson, C. M., & Deighton, J. (1988). Negotiated belief structures and decision performance: An empirical investigation. *Organizational Behavior and Human Decision Processes*, 42, 194-216.

Walsh, J. P. & Ungson, G. R. (1991). Organizational memory. *Academy of Management Review*, 16, 57-91.

Walsh, R. L. (1994). *Lawyers' attitude toward information*. Unpublished masters of science, City University, London.

Wang, P. (1999). Methodologies and methods for user behavior research. In M. E.Williams (Ed.), *Annual review of information science and technology* (Vol. 34, pp. 53-99). Medford, NJ: Information Today.

Ward, M. (2001). A survey of engineers in their information world. *Journal of Librarianship and Information Science*, 33(4), 168-176.

Warren, C. A. B. (2002). Qualitative interviewing. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 83-101). Thousand Oaks, CA: Sage Publications.

Wegner, D. M. (1987). Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of group behavior* (pp. 185–208). New York: Springer-Verlag.

Wegner, D. M. (1995). A computer network model of human transactive memory. *Social Cognition*, 13(3), 319-339.

Wegner, D. M., Erber, R., & Raymond, P. (1991). Transactive memory in close relationships. *Journal of Personality and Social Psychology*, 61, 923-929.

Wegner, D. M., Giuliano, T., & Hertel, P. (1985). Cognitive interdependence in close relationships. In W. J. Ickes (Ed.), *Compatible and incompatible relationships* (pp. 253-276). New York: Springer-Verlag.

Weick, K. E., & Roberts, K. H. (1993). Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly*, 38, 357-381.

Weinschel, B. O., & Jones, R. C. (1986). *Toward the more effective utilization of American engineers.* Washington, D.C.: American Association of Engineering Societies.

Weldon, E., & Gargano, G. M. (1985). Cognitive effort in additive task groups: The effects of shared responsibility on the quality of multiattribute judgments. *Organizational Behavior and Human Decision Processes*, 36, 348-361.

Whitley, R., & Frost, P. (1973). Task type and information transfer in a government research lab. *Human Relations*, 25, 537-550.

Whyte, G. (1993). Escalating commitment in individual and group decision making: A prospect theory approach. *Organizational Behavior and Human Decision Processes*, 54, 430-455.

Wicks, D. A. (1996). *The information-seeking behavior of pastoral clergy: A study of the interaction of work worlds and work roles*. Unpublished doctoral dissertation, University of Western Ontario, London, ON.

Widen-wulff, G. (2003). Information as a resource in the insurance business: The impact of structures and processes on organization information behaviour. *New Review of Information Behavior Research*, 4(1), 79-94.

Wildemuth, B. M., de Bliek, R., Friedman, C. P., & File, D. D. (1995). Medical students' personal knowledge, searching proficiency, and database use in problem solving. *Journal of American Society for Information Science*, 46(8), 590-607.

Wilkinson, M. A. (2001). Information sources used by lawyers in problem solving: An empirical exploration. *Library & Information Science Research*, 23(3), 257-276.

Williams, F., & Gibson, D. V. (Eds.). (1990). *Technology transfer: A communication perspective*. Newbury Park, CA: Sage Publications.

Wilson, G. (1996, October). Training is necessary, but not sufficient. *Fire Chief*, 40(10), 22-24.

Wilson, P. (1983). *Second-hand knowledge: An inquiry into cognitive authority*. Westport, CT: Greenwood Press.

Wilson, T. D. (1981). On user studies and information needs. *Journal of Documentation*, 37(1), 3-15.

Wilson, T. D. (1984). The cognitive approach to information-seeking behavior and information use. *Social Science Information Studies*, 4, 197-204.

Wilson, T. D. (1994). Tools for the analysis of business information needs. *Aslib Proceedings*, 46(1), 19-23.

Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation*, 55(3), 249-270.

Wilson, T. D., & Streatfield, D. R. (1977). Information needs in local authority social services departments: An interim report on project INISS. *Journal of Documentation*, 33(4), 277-293.

Winter, M. F. (1988). *The culture and control of expertise*. New York: Greenwood.

Wittenbaum, G. M., Vaughan, S. I., & Stasser, G. (1998). Coordination in task-performing groups. In R.S. Tindale, L. Heath, J. Edwards, E. J. Posavac, F. B. Bryant, Y. Suarez-Balcazar, E. Henderson-King, & J. Myers (Eds.). *Theory and research on small groups* (pp. 177-204). New York: Plenum.

Woodburn, I. N. (1969). A mathematical model of hierarchical library system. In A. G. Mackenzie & I. M. Stuart (Eds.), *Planning Library Services: Proceedings of a Research Seminar Held at the University of Lancaster, 9-11, July 1969*. University of Lancaster Library Occasional Papers, no.3. Lancaster: University of Lancaster Library.

Woolf, S. H., & Benson, D. A. (1989). The medical information needs of internists and pediatricians at an academic medical center. *Bulletin of the Medical Library Association*, 77, 372-380.

Wutz, T. J. (2004). Self-contained breathing apparatus. In S. Clark (Ed.), *Firefighter's handbook, basic essentials of firefighting* (Chapter 7, pp. 141-182). Clifton Park, NY: Thomson, Delmar Learning.

Xu, Y., Tan, B., & Yang, L. (2006). Who will you ask? An empirical study of interpersonal task information-seeking. *Journal of the American Society for Information Science and Technology*, 57(12), 1666-1677.

Yarmey, D. A. (1992). The effects of dyadic discussion on earwitness recall. *Basic and Applied Social Psychology*, 13, 252-263.

Yitzhaki, M. & Hammershlag, G. (2004). Accessibility and use of information sources among computer scientists and software engineers in Israel: Academy versus industry. *Journal of the American Society for Information Science and Technology*, 55(9), 832-842.

Young, J. F., & Harriott, L. C. (1979). The changing technical life of engineers. *Mechanical Engineering*, 101(1), 20-24.

Zeffane, R., & Gul, F. (1993). The effects of task characteristics and sub-unit structure on dimensions of information processing. *Information Processing & Management*, 29(6), 703-719.

Zipf, G. K. (1949). *Human behavior and the principle of least effort: An introduction to human ecology*. New York: Hafner Publishing.

Zsambok, C. E. (1997). Naturalistic decision making: Where are we now? In C. E. Zsambok and G. E. Klein (Eds.), *Naturalistic decision making* (pp. 3-16). Mahwah, NJ: Lawrence Erlbaum Associates.

Zsambok, C. E., Beach, L. R., & Klein, G. (1992). *A literature review of analytical and naturalistic decision making. Technical report, Naval Command, Control and Ocean Surveillance Center*, *Research*, *Development*, *Test*, *and Evaluation Division*. Retrieved from http://www.au.af.mil/au/awc/awcgate/navy/klein_natur_decision.pdf

Zsambok, C. E., & Klein, G. (Eds.) (1997). *Naturalistic decision making*. Mahwah, NJ: Lawrence Erlbaum Associates.

APPENDIX A

FIREFIGHTERS DAY SCHEDULE
A TYPICAL WORK DAY SCHEDULE FOR A 24-HOUR SHIFT IN A FIREHOUSE

Time	Duty and Activity
0700	Line-up and equipment check. Send morning report to battalion chief. Clean quarters, empty trash, clean dishes
0800	Dust and vacuum all carpeted areas. Sweep all the floors
0830	Physical training and outside skill drill
1100	Heavy cleaning (while still in physical training clothes). . Monday-Air out bunkroom and rotate mattresses, clean all windows . Tuesday – Clean utility rooms and shop areas . Wednesday – Clean and inventory EMS, SCBA, and decontamination areas . Thursday – Move recyclables outside for pickup then clean weight room and lockers . Friday – scrub kitchen and clean out refrigerators
1130	Scrub bathrooms after fire fighters clean up from physical training
Noon	Lunch
1330	Scheduled productivity activity (e.g., fire safety inspections, school visits, inside or outside training)
1800	Dinner, followed by kitchen clean-up. Run dishwasher
1930	Individual study time, occasional fire safety inspections (nightclubs) or drills
2130	Remove all trash, tidy up day room and make final pass through the kitchen.

Source: International Association of Fire Chiefs and National Fire Protection Association. (2006). *Fire officer, principles and practice.* Sudbury, MA: Jones and Bartlett Publishers, p. 42.

APPENDIX B

SAMPLE NFPA STANDARDS FOR TRAINING AND CERTIFICATIONS

NFPA standards detail minimum qualifications for fire service personnel. The most current editions can be found in the *Online NFPA Standards* (National Fire Protection Association, 2008). Some sample standards for training and certification are listed below (Estepp, 1993):

Standard	Certification Available
NFPA 1001: *Standard for Fire Fighter Professional Qualifications*	Firefighter I, II, III
NFPA 1002: *Standard for Fire Apparatus Driver/Operator Professional Qualifications*	Fire Apparatus Driver/Operator
NFPA 1003: *Standard for Airport Fire Fighter Professional Qualifications*	Airport Firefighter
NFPA 1021: *Standard for Fire Officer Professional Qualifications*	Fire Officer I, II, III, IV
NFPA 1031: *Standard for Professional Qualifications for Fire Inspector and Plan Examiner*	Fire Inspector
NFPA 1033: *Standard for Professional Qualifications for Fire Investigator*	Fire Investigator
NFPA 1035: *Standard for Professional Qualifications for Public Fire and Life Safety Educator*	Fire and Life Safety Educator
NFPA 1041: *Fire Service Instructor Professional Qualifications*	Fire Service Instructor
NFPA 472: *Standard for Professional Competence of Responders to Hazardous Materials Incidents*	Hazardous Materials Responder
NFPA 1051: *Standard for Wildland Fire Fighter Professional Qualifications*	Wildfire Management Personnel
NFPA 1061: *Standard for Professional Qualifications for Public Safety Telecommunicator*	Public Safety Telecommunicator

Note: The NFPA 1041 identifies performance standards for fire service instructors. It specifies the information instructors need to meet minimum knowledge and skill level requirements.

APPENDIX C

SNAPSHOT OF THE FIRE ACADEMY'S TRAINING CALENDAR

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Essentials III Thermal Imaging Camera Training	**2** Firefighter Rescue and Survival Essentials III Essentials II	**3**	**4** Essentials II	**5**	**6** Basic Aerial Apparatus Operations Basic Auto Extrication Basic Engine Company Operations Fire Prevention Principles Rapid Intervention Team Basics-Theory, Tools and Implementation Rapid Intervention Team Basics-Theory, Tools and Implementation Statewide WMD Response: Hazardous Materials Awareness
8 Command & General Staff Functions for Local Incident Management Teams Instructor I	**9** Command & General Staff Functions for Local Incident Management Teams Instructor I Essentials III Handline Operations and Application	**10** Command & General Staff Functions for Local Incident Management Teams Instructor I Building Construction Fire Origin and Cause Awareness	**11** Command & General Staff Functions for Local Incident Management Teams Instructor I Essentials II	**12** Command & General Staff Functions for Local Incident Management Teams Instructor I Fire and Arson Investigation I	**13** Basic Auto Extrication Essentials I Fire and Arson Investigation I Fire Prevention Principles Fire Service Vehicle Operator Statewide WMD Response: Hazardous Materials Awareness Statewide WMD Response: Technical Rescue Awareness

Appendix C (cont.)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
15 Ethanol Awareness Essentials I New Car Technology	**16** Introduction to Incident Action Planning for Public Employees Commercial Building Operations Essentials III Overhaul and Salvage Essentials II	**17** Introduction to Incident Action Planning for Public Employees Down and Dirty Hydraulics Essentials II Fire Behavior and Smoke	**18** Fire Service Vehicle Operator	**19** Statewide WMD Response: Hazardous Materials Incident Management System	**20** Statewide WMD Response: Hazardous Materials Incident Management System Essentials I Essentials I Fire Behavior and Smoke Fire Prevention Principles Firefighter Rehabilitation and Heat Stress Management Fireground Management for Small Career and Volunteer Departments Fires on the Farm NFA Incident Safety Officer Statewide WMD Response: Hazardous Materials Operations Statewide WMD Response: Technical Rescue Awareness Basic Company Officer Training
22 Instructor II Management IV Fire Behavior and Smoke	**23** Instructor II Management IV Essentials III Ethanol Awareness Overhaul and Salvage Essentials II	**24** Instructor II Management IV Basic Engine Company Operations Essentials II New Car Technology	**25** Instructor II Management IV Fire Service Vehicle Operator	**26** Instructor II Management IV Fire and Arson Investigation I	**27** Advanced Auto Extrication Basic Company Officer Training Fire and Arson Investigation I Fire Service Vehicle Operator Fireground Management for Small Career and Volunteer Departments Statewide WMD Response: Hazardous Materials Operations

APPENDIX D

CURRICULUM DEVELOPMENT IN FIREFIGHTING PROGRAM COURSES

Firefighting Program Courses	**Field Staff Instructor's Duty**	**Knowledge** **Cognitive Domain**	**Skills** **Psychomotor Domain**	**Affective (Attitude)** **Affective Domain**
Advanced Breathing Apparatus Specialist (Smoke Divers)	Develop curriculum	Types and limitations of breathing apparatus	Use of breathing apparatus	Attitude change; Appreciation; Real understanding; Respect of mechanical system
Basic Firefighter Practical Academy	Develop 4-week (100% hands-on)	Basic aspects of fire suppression: firefighting, fire behavior, tools, equipment	Basic operations	Teamwork attitude; Responsibility; Respect of fire; No freelancing
Certified Firefighter II Academy	Develop 6-week (2/3 hands-on, 1/3 classroom lecture)	Basic aspects of fire suppression: firefighting, fire behavior, tools, equipment	Basic operations	Teamwork attitude; Responsibility; Respect of fire; No freelancing
Down and Dirty Hydraulics	Refine the curriculum (largely classroom)	Knowledge of water, engine pressure, and simple math	Hydraulic calculation; Pump and water pressure	Appreciation of water pressure; Hose line safety and effectiveness
Engine Company Operations	Develop 3-day class; Develop 1-day class (1/3 classroom, 2/3 hands-on)	Different hose load; advance hose effectively; Hose line control to building	Primary operational skills	Wider perspectives; Open eyes; Home department skill enhancement and comparison
Essentials I	Develop curriculum (80-90% hands-on)	Basics of firefighting operations especially useful for rural, small town volunteer fire department	Basic firefighting operations	Teamwork; Motivation
Essentials II	Develop curriculum	Basics of firefighting operations especially useful for rural, small town volunteer fire department	Basic firefighting operations	Teamwork; motivation

Appendix D (cont.)

Firefighting Program Courses	Field Staff Instructor's Duty	Knowledge Cognitive Domain	Skills Psychomotor Domain	Affective (Attitude) Affective Domain
Essentials III	Develop curriculum	Basics of firefighting operations especially useful for rural, small town volunteer fire department	Basic firefighting operations	Teamwork; Motivation
Essentials IV	Develop curriculum	Basics of firefighting operations especially useful for rural, small town volunteer fire department	Basic firefighting operations	Teamwork; Motivation
Fire Apparatus Engineer (FAE)	Develop curriculum	Basic pump and aerial ladder; Hydraulic calculation; Engine pressure; Math; More in-depth and beyond basics	Fire apparatus operations and maintenance	Pride in career firefighters' ability to do job effectively
Fire Attack and Suppression Techniques	Develop curriculum (10% classroom, 90% hands-on)	Higher level than basics; Understanding how, why; Alternative ways/options	Advanced skills building on other basics	Teamwork; self-confidence; aggressiveness
Fire Service Vehicle Operator (FSVO)	Develop curriculum	Speed control of large engine on narrow roads	Safe vehicle driving	Effectiveness; Safety; Defensive driving attitude
Fireground Command Officer School	Develop curriculum (5-day-on site only; a day and half in classroom; rest on hands-on)	Oversee multi-company operations; Communications; Decision-making; Basic tactics; Coordination; Supervision; Formulation of a plan; Problem-solving	Fireground operations	Ability to think reasonably; Calm; Timely reaction; Empathy to others

Appendix D (cont.)

Firefighting Program Courses	Field Staff Instructor's Duty	Knowledge Cognitive Domain	Skills Psychomotor Domain	Affective (Attitude) Affective Domain
First-in Company Officer	Develop < 16 hours based on Foreground Command Officer	Company officer responsibility in front lines; Coordination; Listening as eyes and ears to Commander; Watch and monitor people	Direct company roles	Change of tunnel view; Wider perspectives; Safety attitude and awareness
Rapid Intervention Team (RIT) Under Fire	Develop 5-day-on-site course; Develop 4-hour off-site delivery (a. basic concepts of RIT; b. large area search; c. RIT development drills)	Importance of safety net – "guardian angels"	Rescue techniques and procedures; Tools	Teamwork; Anticipation and preparation ahead of time
Saving Our Own	Refine existing class into modules, i.e., a) Firefighter survival concepts; b) Approaching the downed firefighters, drags, carries; c) Moving firefighters up/down stairs, up/down ladders; d) Removing firefighters from basements and windows (100% hands-on)	Situations in firefighters' deaths; Analysis of what happened in past events; Prevention of future tragedies; what to do if it happens	Techniques and skills on various situations to get firefighters out	Smart; No trouble making; Cool and calm; Self- and buddy-out

Appendix D (cont.)

Firefighting Program Courses	Field Staff Instructor's Duty	Knowledge Cognitive Domain	Skills Psychomotor Domain	Affective (Attitude) Affective Domain
Thermal Imaging Camera Classroom	Develop the modules and PowerPoint (3-4 hours); Develop TIC hands-on modules (3-4 hours)	Different techniques, ways and types of operation; Pros and cons	How to operate mechanically	Not too confident; No tunnel vision
Truck Company Operations	Develop 4-day class; Develop 2-day class (hands-on mostly)	Role of truck support fireground operations	Practice the operational techniques; Control action in time with other actions; More individual coordination; Communication with officer about task completion	Attitude change; Aggressiveness building and control; Teamwork
Basic Wildland	National Wildland Forest Service curriculum (1/4 hands-on)	Basics of Urban/Wildland firefighting and follow national system	Wildland fire operations	Awareness of importance and difference of wildland fires

APPENDIX E

THE FIRE ACADEMY'S FIREFIGHTING PROGRAM COURSE DESCRIPTIONS (PARTIAL LIST)

(Provided by the Fire Academy)

Advanced Breathing Apparatus Specialist (Smoke Divers)

The emphasis of this course will be the safe and efficient use of self-contained breathing apparatus. This program emphasizes core skills such as: donning, doffing, shifting, dumping, emergency procedures, and buddy-breathing. Following demonstrated mastery of these core skills, the student will work in real and simulated fire conditions while performing functions where self-contained breathing apparatus are essential, including fireground search, air conservation, self rescue, and firefighter rescue techniques.

Basic Firefighting Practical Academy

This 4-week program is designed to serve firefighters that have completed the Academy On-line Firefighter Program, or are already certified at the Firefighter II level and would benefit from additional exposure to hands-on skills training and live-fire exercises. It will cover firefighting practicals with the same intensity and environment as the 6-week program, but without the classroom component. Night drills, LP training, and a firehouse environment are all components of this challenging program.

Certified Firefighter II Academy

The Certified Firefighter II Academy is offered twice a year to assist fire departments in training their new members. This course covers the subjects required for certification, as well as incorporating a fire department atmosphere into the training. The candidate's daily routine includes a daily PT regimen, apparatus checks and station cleaning, daily quizzes on cognitive information, classroom lectures, demonstrations, hands-on practice on individual skills, training responses that incorporate these individual skills into fireground evolutions, night drills, team work, and a Line-of- Duty-Death project, where the student will be able to learn from a tragedy in our profession to enrich his or her career. The program emphasizes developing the skills and knowledge necessary for entry-level personnel to become functioning members of a fire company.

The weeks following the Certified Firefighter II Academy are dedicated to offering the courses necessary to round out a new candidate's initial training. In the week immediately following Academy, THE ACADEMY offers Technical Rescue Awareness, Hazardous Materials Awareness, IS-700, Fire Service Vehicle Operator (Classroom Portion Only), CPR and Basic First Aid. (These topics are no longer included as part of the six-week academy program.)

Hazardous Materials Operations is offered the second week following Academy, followed by either the three-week EMT-Basic or the one-week Vehicle/Machinery Operations course.

Down and Dirty Hydraulics

Are you a math-o-phobic? Can't make heads or tails out of hydraulic formulas or calculations? This course is for you! Spend some time and really learn how to do hydraulics, down and dirty, so you can do them in the field where it really counts! This program is designed to ease the fear and confusion so often accompanying the required hydraulics problems on today's fireground. This classroom session takes the theory of pump operation and creates a practical application for firefighters to calculate proper fire apparatus pump pressures. Once completed, students will be capable of generating safe and effective fire streams for single pumper operations, as well as more complicated multi-unit, supply, relay and fire attack operations.

Engine Company Operations

This program is designed for firefighters who are primarily assigned to, or respond as members of an Engine Company. The program offers firefighters an opportunity to either sharpen their current skills, or learn new and efficient skills for the all-important task of getting water on the fire. This program is an intensive hands-on program, and includes opportunities to select and evaluate a variety of differing hose loads and line advancement techniques. Instructors for this class are brought in from a variety of departments, seeking to bring differing geographical solutions to the table for a variety of fireground evolutions.

Essentials I

This is the first class of a series laying the foundation for basic firefighting skills and "hands on" activities of a first responder. Beginning with personal safety, fire behavior, the hands-on fundamentals of utilizing self contained breathing apparatus, ladder raising and climbing skills as well as hose loads and advances. A portion of class will deal with the rudimentary principles of pumping apparatus for the purpose of maintaining an adequate fire stream. Although thorough in its scope, this should be considered a starting point for departments with a young and inexperienced roster. A great class for the veterans to refresh their skills and mentor the new firefighters on the department rolls.

Essentials II

The second class of a series of firefighting skills and "hands on" activities building on the hose, ladders, and breathing apparatus skills of Essential I. With the background of Fire Scene Operations, the class focuses on fire attack techniques, ventilation, and forcible entry with instruction on the proper use of the tools of the trade. Emphasis on the safety skills with the self contained breathing apparatus, fire service ladders, small tools, and hose evolutions round out this 15 hour offering.

Essentials III

The third class of a series of firefighting skills and "hands on" activities brings new information to the table. Related Fire Scene operational skills focus on proactive portions of the duties of the fire attack. Subjects like public education, pre-fire planning and its relation to local building construction, calculating critical fire flow and maintaining adequate fire streams fill out some of the class sessions. Various evolutions working with obtaining and maintaining an adequate water supply and working with hand lines and/or master streams round out some of the practical skills of fundamental firefighting. Fire service rope practices for utilization on the fireground for hoisting and other uses finish the instructional module.

Essentials IV

Essentials IV becomes the "customized" OR "other" class enhancing previously learned fire service skills to a group of fire departments, MABAS Division, Regional School or Mutual Aid Association. This allows the organization to design a class with the cooperation of the instructor meeting the needs and building on hands-on skills. Topics can be chosen from the list of Essentials skills to mix and match or concentrate on one skill the local agency may feel merits more in depth training. Provided the subject is fundamental to the mission of the local Fire Service group requesting the training, it is an ideal venue for various refresher level training.

Fire Apparatus Engineer (FAE)

The Fire Apparatus Engineer course is designed for firefighters who are assigned to operate fire department apparatus in the normal course of their duties. It is designed to develop a firefighter in the areas of principles of water and water systems, mechanical principles of pumps, pumps and pump controls, intake and discharge hydraulics, aerial apparatus considerations, apparatus spotting, fire stream development, pump maintenance, service testing, acceptance testing, and pump troubleshooting. The FAE will be able to generate effective fire streams from hydrants, relay operations, and drafting from static sources. Hose situations will range from single line problems up through multiple-line relay operations to give the students a solid understanding of fireground hydraulics, as well as practical solutions to be able to apply these concepts to their department.

Fire Attack and Suppression Techniques

The F.A.S.T. course is designed for those firefighters seeking to advance their basic skills training or for those seeking additional live firefighting experience. The course will emphasize advancing proficiency in hose and ladder handling, forcible entry, SCBA, search and rescue, structural fire attack, ventilation, and stream operations. Training responses and acquired structures will be utilized to provide a challenging learning environment.

Fire Service Vehicle Operator (FSVO)

This course is designed for engineers and officers of a fire department who (as part of their duties) are responsible for the safe operation of a fire service vehicle.Topics include special hazards unique to Fire Apparatus drivers, selecting and training new and existing driver/operators, developing SOGs to assist in your department's D/O program, pre-trip inspections, and safe operation during emergency and non-emergency driving.

This class will provide the classroom presentation, and instruct the department on how to set-up and run the driving portion of the certification requirements. Additional time will be necessary for drivers to have practice time driving the apparatus, and to complete the driving course. A minimum of a valid Illinois class B non-CDL drivers license is required for the road-testing portion.

Fireground Command Officer School

This five day class is designed to help command officers gain the knowledge and practical skills required to effectively direct multiple companies at a fire. Classroom discussions of leadership, responsibilities, and tactics will be coupled with four days of demonstrations and hands-on practice of directing live-fire evolutions. Each student will take the role of a command officer. Afterwards, each evolution will be critiqued by their fellow students and instructors.

Basic Company Officer Training (formerly First-in Company Officer)

This Down & Dirty class is customized for fire departments and mutual aid associations emphasizing the decisions to be made and the actions to be taken by fireground supervisors, using traditional tactical priorities. The class is tailored for the size and type of department.

Rapid Intervention Team (RIT) Under Fire

RIT Under Fire will instruct tactical and strategic intervention operations using repeated "Mayday" deployments into various types of occupied structures using live fire conditions, a review of firefighter injury and fatality case studies, demonstrations and lecture materials. This program is designed for the ranks of firefighter, company officer, and chief officer. Firefighters will operate under the direction of a R.I.T. company officer, will execute skills such as search and Rope Assisted Search Procedures (RASP) operations, victim extrication, and disentanglement. The company officer will direct and manage the search operations, size-up conditions, and execute the rescue. The chief officer will manage the rescue sector and a R.I.T. sector by executing multiple search and rescue action plans and accountability. The class will progress from the rescue of a single disoriented firefighter under smoke conditions to a more complex evolution involving several firefighters trapped in a burning structure where concrete slabs and steel debris must be lifted or cut to free the firefighters.

Saving Our Own

"Saving Our Own" is a nationally recognized program to help firefighters escape from situations that have cost other firefighters their lives. Initial classroom emphasis addresses how to keep our firefighters from getting into trouble in the first place. We look at case studies of actual firefighter fatalities, and make suggestions on how to handle or prevent similar situations. Controlling fireground emergencies, and Rapid Intervention Teams are discussed, but the focus is on non-complex, single firefighter rescue techniques. Simple techniques for rescuing trapped firefighters, using basic equipment readily available at all fires, are demonstrated and practiced. This intense three-day seminar is also available in a condensed 2-day format on contract.

Thermal Imaging Camera Classroom

This class is intended to familiarize the firefighter with application and use of a Thermal Imaging Camera. The class will include; how a Thermal Camera operates, situations where a camera can assist the firefighter, situations where a camera may not be reliable, and departmental SOGs for camera usage. Several manufacturers will have products at each class. THE ACADEMY does NOT endorse a particular brand of camera over any other, but is making a variety of cameras with different advantages and disadvantages available to the Illinois fire service for comparison.

Truck Company Operations

This 32-hour program is designed for firefighters who are primarily assigned to, or respond as members of a Truck or Ladder Company. The program offers firefighters an opportunity to either sharpen their current skills, or learn new and efficient skills for all the various tasks required of truck company members. This program is an intensive hands-on program, and includes training responses to structural fires to provide an opportunity to experience the role of the truck company at a fire. Topics include riding assignments and personnel deployment, ground ladders, aerial device tactical considerations and spotting, forcible entry for residential and commercial construction, including the use of hand, power, and hydraulic tools, proper horizontal and vertical ventilation, fireground search and rescue, salvage, and overhaul.

Basic Wildland

This class includes working within the Incident Command/Management System in a wildland environment, followed by basic fire behavior factors and firefighting skills and safety, avoiding hazardous situations, hand tools and their use, prescription burn management, and the effects of wildland fires on the environment. A hands-on exercise will help students apply the concepts learned in class. This class satisfies the requirements for a NWCG (National Wildfire Coordination Group) Red Card, with the exception of the pack test.

APPENDIX F

HIRING CRITERIA FOR THE FIRE ACADEMY'S FIELD STAFF INSTRUCTORS

According to the Fire Academy, Assistant Field Staff Instructor must be able to

1) Demonstrate fire emergency service teaching experience within one's own fire department, at regional classes, community colleges, as a Fire Academy's adjunct instructor or other appropriate fire emergency service education forums;
2) Have operational experience: three plus years of operational fire emergency service or professional experience in the specific area of expertise for which being considered;
3) Hold professional reputation: outstanding professional reputation with acknowledged expertise in the curriculum area to which appointed;
4) Obtain fire chief's approval;
5) Provide recommendations by a Fire Academy's instructor or other appropriate personal recommendation.

Associate Field Staff Instructor must be able to

1) Demonstrate fire emergency service teaching experience: a minimum of 60 hours of teaching experience as an Assistant Field Staff Instructor, and evidence of a superior teaching performance as determined by student, peer and supervisor evaluations;
2) Have operational experience: five plus years of operational fire emergency service experience;
3) Membership in a fire, rescue, emergency medical service or other related unit;
4) Engage in public service activities: leadership in fire emergency service training/education outreach between the Illinois firefighters and fire departments and the Fire Academy; presentations to fire emergency service associations, community groups, business/industry or other groups about fire emergency service training programs and the Fire Academy;
5) Participate in curriculum development: a) develop or significantly assist in the development or major revision of a new class, course or curriculum; b) development of innovative teaching methods or instructional aids or devices;
6) Do continuing education: a) attend at least one professional conference, seminar or fire emergency service related educational activity each year; b) visit fire emergency service units, facilities, training programs to study methods, facilities, policies, in order to improve professional and Fire Academy's curriculum;
7) Provide publications: a) author fire emergency service related articles that receive state, national and/or international coverage; b) produce audio-visual materials, computer-based education programs; c) develop and deliver substantive public speeches on fire emergency service subjects;
8) Conduct research: participate in a fire emergency service related research project;

9) Pursue higher education: demonstrate significant effort toward the attainment of a higher education degree in fire science or related curriculum area.

Field Staff Instructor must be able to

1) Meet all of the required criteria for Associate Field Staff Instructor;
2) Have individual professional development through continuing education, publication, research activities and/or higher education;
3) Provide evidence of regular participation in Fire Academy’s activities, such as, attending instructor meetings and participation in Fire Academy’s curriculum or other committees;
4) Make contributions to the advancement of fire suppression, prevention, and/or training as a result of scholarship, research, invention or other creative activity; continuous outstanding teaching performance.

APPENDIX G

STUDIES ON INFORMATION-SEEKING OF ENGINEERING

Previous ARIST (Annual Review of Information Science and Technology) chapters, such as Menzel (1966), Herner and Herner (1967), Paisley (1968), Allen (1969), Lipetz (1970), Crane (1971), Lin and Garvey (1972), Martyn (1974), Hewins (1990), work on engineering information systems (Mailloux, 1989), gatekeepers (Metoyer-Duran, 1993) and other reviews of information needs and uses were concerned primarily with engineers. Several books are important literature reviews. They are *Key Papers in Information Science*, edited by Griffith (1980), *Encyclopedia of Library and Information Science*, edited by Kent (1989), *Communication among Scientists and Engineers*, edited by Nelson and Pollock (1970), *Technology Transfer: a Communication Perspective*, edited by Williams and Gibson (1990). Besides an excellent review done by King, Casto and Jones (1994), Pinelli's (1991) literature review provided specific discussions about the information-seeking processes of engineers, differences between engineers and scientists, and factors that affect use of information and information sources. He also covered studies of Herner (1954), Rosenbloom and Wolek (1967), Allen (1977), Kremer (1980), Shuchman (1981) and Kaufman (1983). Poland (1991) offered a literature review concerning information communication among scientists and engineers. All of them provide substantial information and data concerning engineers' information use and needs. Typically, this body of literature focuses on habits of journal or library usage and citation practices or patterns of interpersonal communication.

APPENDIX H

INTERVIEW GUIDE

Hi, _______, nice meeting and talking to you. My name is Lian. I am the Principal Investigator conducting this interview. Thanks for giving me the opportunity to talk with you. The interview session lasts approximately 60 to 90 minutes.

Please paint me a *detailed* picture about your process for your training, teaching and curriculum development activities. Give me enough specific details on how you thought, what you did, where you looked, who you asked, who you worked with, and what results, etc.

Let's go over the **Information for Interview Participants** and **Consent Form**.

Please sign the **CONSENT FORM** before we start the interview and you will keep a copy for your record.

1. Tell me about your training and teaching activities at the Fire Academy. Describe and explain how you do them.

(Probe questions:

1) What subject(s) do you teach and train the most?
2) Do you teach the same subject all the time?
3) How do you allocate your time?
4) How do you plan, outline and prepare sessions?
5) How do you address objectives and test outcomes?)

2. Describe a recent curriculum development project at the Fire Academy in which you were engaged. Please describe enough details so I can understand your process on how you did it.

(Probe questions:

1) What is the course title?
2) When did you do it?
3) Was it a New Course or you revised it?
4) If it's a new course, how did you do it - following structural (The Academy new course proposal phases), unstructured, or your own way?
5) How did you interact with curriculum development group members and other instructors?
6) Please explain how you sought and gathered information.
7) How did you seek and use references?
8) Where did you get information?
9) Who did you ask to get feedback?
10) Who had to review the information?
11) How information-seeking and sharing happened to your project:

. At the beginning of the curriculum development project: Once you are a little further into the project, what would you do? Where would you look?

. A little later in your project, perhaps when you have done some searching or worked for a while on the project, what would you do?

. As your work progresses towards completion of the curriculum, what would you do?

. Regardless of how you answered the last question, if a specific need occurred at your work tomorrow, how would you probably go about obtaining the necessary information?)

3.1 Describe the most difficult aspect of your training and teaching as an instructor. How did you convey the Knowledge, Skills and Affective of your class to your students?

3.2 Describe the most difficult aspect of your most recent curriculum development project.

(Probe questions:
1) What obstacles do you perceive when you search and share information with other instructors and students? Give specific examples.
2) How did these difficulties inter-relate? Did one affect another? Give specific examples.)

4. What obstacles are typical to your training, teaching and curriculum development work? Give specific examples.

(Probe question:
1) Define obstacles, such as training facilities, tools, training props, student's maturity, scheduling, classroom, class size, technology, material preparation, testing/grading or information-seeking, etc.)

5. Have your information-seeking problems changed over time? If yes, do you account for the change, i.e., because of your daily routine (training, teaching, curriculum development and actual emergency response) or because sources of information have changed? Give specific examples.

6. Do you rely on any particular a) Experience, b) People, c) Personal collection as top sources for your teaching, training and curriculum development?
(Probe question:
1) Can you rank them? 1 is the most important.)

7. How particularly helpful and important is experience to your training, teaching and curriculum development, including your own experience, other instructors' and students' experience, in classroom lecture teaching and hands-on skill training?

8. What types of information materials do you seek and use to resolve the typical problems and make decisions about your training, teaching and curriculum development project? Give specific examples, e.g., experienced instructors and officers, books, videos, magazines, etc.

9. How do you decide that you have enough information?

(Probe questions:

1) When do you stop searching for information?)

10. Think about a most memorable experience of curriculum development group work that affected your information-seeking. Be sure to tell me about makeup of the group that was involved, what kinds of information were sought, and where did you look, how you knew the information found was helpful to the group's performance. Please relate as many details as possible.

(Probe questions:

1) When did this experience happen?
2) How did you work together to find answers to questions?
3) Where did you look for information?
4) How did you do it? Individually or collectively?
5) How did you share information with each other within group and outside group to make future decisions?)

11. What would be your recommendation to someone who is starting similar work of training, teaching and curriculum development so that they would increase their chances of finding relevant information?

(Probe question:

1) What is your most important recommendation?)

12. To what degree are your instructional activities that lead to your information-seeking informed by the Recognition-Primed Decision Model (RPD)?

(Probe questions:

1) Have you seen or heard of the RPD Model before?
2) If yes, could you please explain how this model influences your training, teaching and curriculum development?)

APPENDIX I

THE FIRE ACADEMY'S FIELD STAFF INSTRUCTOR'S PROFILE

Assigned # ______________ Date _____________ Age ______ Gender: M ___F_____
Fire Department Name_____________ Paid____ Paid on call____ Volunteer___ Combined______

Education (Degree)	. High school _____ . Associate _______ . Year completed______ . Major______ . Undergraduate ______ . Year completed______ . Major______ . MA/MS _______ . Year completed______ . Major______ . Ph.D. ________ . Year completed______ . Major______
Experience as Instructor	. Years in Fire Service:___________ . Ranking within Your Fire Department:_________ . Ranking as IFSI Field Staff Instructor: ___________ . Years of training and teaching in fire service: _________ . Years of training and teaching in IFSI: ___________ . Years in curriculum development projects: __________
Programs You Taught (Check all that apply)	. Firefighting _________ . Fire Officer_________ . Cornerstone__________ . Hazardous Materials _____ . Rescue____ . (Fire) Investigation_________ . Fire Prevention_______ . Industry_______ . Emergency Medical Services (EMS)________ . Other________
Specialty besides Fire Service	. Nurse ______ . Architect _________ . Engineer_________ . Policeman________ . Other_____
Curriculum Development Projects You were Involved in (Check all that apply)	. Firefighting _________ Course Title: Who was on the project: Date: Who was on the project: Date: . Fire Officer__________ Course Title: Who was on the project: Date: Who was on the project: Date: . Cornerstone__________ Course Title: Who was on the project: Date: Who was on the project: Date:

Appendix I (cont.)

Curriculum Development Projects You were Involved in (Check all that apply)	. Hazardous Materials (Hazmat)_____ Course Title: Who was on the project: Date: Who was on the project: Date: . Rescue____ Course Title: Who was on the project: Date: Who was on the project: Date: . Investigation_______ Course Title: Who was on the project: Date: Who was on the project: Date: . Fire Prevention_______ Course Title: Who was on the project: Date: Who was on the project: Date: . Industry_______ Course Title: Who was on the project: Date: Who was on the project: Date: . Emergency Medical Services (EMS)________ Course Title: Who was on the project: Date: Who was on the project: Date:

Appendix I (cont.)

Most Recent Course Taught (if you taught multiple times) and Teaching Groups (Check all that apply)	. Firefighting _________ Course Title: Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date: . Fire Officer__________ Course Title: Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date: . Cornerstone__________ Course Title: - Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date: . Hazardous Materials (Hazmat)_____ Course Title: Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date: . Rescue____ Course Title: Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date: . Investigation_______ Course Title: Who was teaching with you: Most Recent Date: Course Title: Who was teaching with you: Most Recent Date:

Appendix I (cont.)

Most Recent Course Taught (if you taught multiple times) and Teaching Groups (Check all that apply)	. Fire Prevention_______ Course Title: Who was on the project: Most Recent Date: Course Title: Who was on the project: Most Recent Date: . Industry_______ Course Title: Who was on the project: Most Recent Date: Course Title: Who was on the project: Most Recent Date: . Emergency Medical Services (EMS)________ Course Title: Who was on the project: Most Recent Date: Course Title: Who was on the project: Most Recent Date:
References Used during Curriculum Development (Check all that apply)	. Your Own Experience ___________ . Expert in the Field __________ . Other Firefighters _________ . DVD ________________ . Video ______________ . CD ______________ . Book _________________ . Textbook _________ . Standards___________ . Magazine___________ . Other________
Communi-cation Tools (Check all that apply)	. Electronic mail __________ . Real-time chat ____________ . Telephone __________________ . Pager ________________ . Fax__________________

APPENDIX J

INFORMATION FOR INTERVIEW PARTICIPANTS

What is the purpose of the study?
The purpose of this study, entitled "Information-seeking and Sharing Behaviors among Fire Service Field Staff Instructors: A Qualitative Study," is to gain further understanding about instructors' information-seeking behavior after the 2007 survey study on "Information Use and Needs of Field Staff Instructors." Through this interview study, we hope to conceptualize the type of information environment that would best support your activities and help clarify the Fire Academy Library's priorities for the development of rich information environments that are responsive to the context of your work.

Who is doing the research?
Lian Ruan, GSLIS Ph.D. Student, conducts the study as her dissertation research. She is a fourth year doctoral student at the Graduate School of Library and Information Science (GSLIS), University of Illinois at Urbana-Champaign.

Who is participating?
25 fire service instructors, who are field staff instructors at the Fire Academy and have been involved with the Fire Academy's curriculum development project(s) are selected to participate in this interview project.

How will the study be done?
25 fire service instructors will complete the interview. The interview study's data collection starts in November 2008 and ends in January 2009.

Will the answers be confidential and voluntary?
Yes.

Does this study have the support of the Fire Academy and your fire department?
Yes.

Who will benefit from the study?
Participants' answers related to information-seeking behavior will assist the Fire Academy's library and other fire libraries to plan and implement more effective services to meet fire service instructors' unique information needs and uses. The instructors will be informed about the outcome of this study and personally benefit from the study findings and improvement of library services.

For further information contact
Lian Ruan
GSLIS Ph.D. Student
University of Illinois at Urbana-Champaign
Champaign, IL 61820
lruan@illinois.edu
Phone: 217 265-6107
Fax: 217 244-6790

You may also contact the Institutional Review Board (IRB) at the University of Illinois at Urbana-Champaign for information about the rights of human subjects in UIUC-approved research. You may e-mail irb@illinois.edu or call 217 333-2670 collect, identifying yourself as a research subject.

APPENDIX K.1

INTERVIEW CONSENT FORM FOR PARTICIPANTS

Who, What, Why, Where, When
Lian Ruan, Ph.D. Student of the Graduate School of Library and Information Science, conducts a study as Principal Investigator, entitled "Information-seeking and Sharing Behaviors among Fire Service Field Staff Instructors: A Qualitative Study." This research study involves 25 fire service instructors.

The purpose of this study is to gain further understanding about fire staff instructors' information practice and information-seeking behavior. Through the study, we hope to conceptualize the type of information environment that would best support your activities and help clarify the library's priorities for the development of rich information environments that are timely responsive to the context of your work.

You are selected and invited to participate in this study because you are a field staff instructor for the Fire Academy and involved with the Academy's curriculum development project(s). Thanks for considering participation in this interview study. You will be asked to take approximately 60 to 90 minutes to answer questions and the interview will be audio taped with your permission. Consent will be obtained from you prior to the interview and a thank-you letter along with a gift certificate will be made to you.

Once completed, the interview answers on audiotapes along with transcripts will be stored and secured in a locked cabinet in Lian Ruan's office. After completing the interviews, Ruan will code and analyze data and interpret the findings. She plans to disseminate the context and purpose of the study, its methods, findings, limitations and conclusions by writing her doctoral thesis, research papers and present research findings at local, regional and national conferences. No individual nor organization names will be identified in any reports, presentations and publications. The data collection stage of the interview will last about a few months from November 2008 to January 2009. It will take another couple of months to do data analysis and research presentations and publications.

Confidentiality
Your responses and any other information obtained related to this study will be confidential. None of the questions require participants to provide information that could lead to their personal identification. Interviews on audiotapes will be put on transcripts and an identification number will be assigned so no personally identifying information can be linked to that data. Although direct quotes will be used, they will not be identified with any specific individual or organization. Information maintained and reported will be stripped of identifying features and represented anonymously. We will keep all interviews and analysis in a locked cabinet and/or secured server only accessible by the investigator. Any names and identifying information will be removed and aggregated data will be reported in papers and presentations.

Voluntary
Your participation in this research is voluntary. You may skip questions or terminate your participation at any time. Your decision to participate, decline or withdraw from participation will have no impact on your present or future relations with the Fire Academy and the University of Illinois at Urbana-Champaign in any way.

Risks and Benefits
There are no known risks from participation in this study beyond those that exist in normal daily life. Still, as this study investigates the work process and information practice, you may feel uncomfortable discussing aspects of your work and may choose to keep some of your activities private.

Although there may not be immediate direct benefits to you as a participant, you will be providing valuable information about your information practices and information-seeking behavior. You may benefit from this project by becoming more aware of your own information practices and how these practices impact your training and teaching. Moreover, there is the potential to aid in the development of information systems and programs that can enhance library programs and information services tailored to your information use environment.

Who to Contact
If you have any questions about the project, please contact the project staff at:

Lian Ruan
GSLIS Ph.D. Student
University of Illinois at Urbana-Champaign
Champaign, IL 61820
Tel. 217 265-6107
Fax: 217 244-6790
E-mail: lruan@illinois.edu

I HAVE READ AND UNDERSTOOD THE INFORMATION ABOVE AND CONFIRM THE FOLLOWING STATEMENTS ON VOLUNTARINESS

I understand that my participation is entirely voluntary.
I understand that I may refuse to participate or may discontinue participation at any time during the project without penalty.
I understand that I may skip any questions that I don't wish to answer.
I grant the investigator permission to use my audio recorded interview and transcripts for Lian Ruan's dissertation.
I grant the investigator permission to use my interview and transcripts for presentations at professional meetings and papers published by professional journals.

Do you give Lian Ruan permission to audio record your interview? Yes ______ No ____

Your signature indicates that you have read and understood the information provided above and have decided to participate. You may withdraw at any time after signing this form.

____
Print Your Name
____
Signature of Participant   Date

Please keep the attached copy of this consent form for your records acknowledging that you have signed the consent form.

If you have any questions about your rights as a participant in this study, please contact the University of Illinois Institutional Review Board at 217 333-2670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

APPENDIX K.2

OBSERVATION CONSENT FORM FOR PARTICIPANTS IN CLASS OBSERVATION

Who, What, Why, Where, When
Lian Ruan, Ph.D. Student of the Graduate School of Library and Information Science, conducts a study as Principal Investigator, entitled "Information-seeking and Sharing Behaviors among Fire Service Field Staff Instructors: A Qualitative Study." This research study involves 25 fire service instructors.

The purpose of this study is to gain further understanding about fire staff instructors' information practice and information-seeking behavior. Through the study, we hope to conceptualize the type of information environment that would best support your activities and help clarify the library's priorities for the development of rich information environments that are timely responsive to the context of your work.

Your class is selected because one of your instructors or you is a field staff instructor for the Fire Academy and involved with the Academy's curriculum development project(s) and may have participated in Ruan's interview study earlier. With your or your leading instructor's permission, Ruan is observing your class to better understand your teaching and training process. Consent will be obtained from you or your leading instructor prior to the observation, and a thank-you letter will be made to you or leading instructor.

Once completed, the observation notes will be stored and secured in a locked cabinet in Lian Ruan's office. The observation data will be coded, analyzed and interpret the findings as needed. Along with the interview data analysis, Ruan plans to disseminate the context and purpose of the study, its methods, findings, limitations and conclusions by writing her doctoral thesis, research papers and present research findings at local, regional and national conferences. No individual nor organization names will be identified in any reports, presentations and publications. The observation will last about a few months from April 2009 to August 2009. It will take another couple of months to do data analysis and research presentations and publications.

Confidentiality
Your responses and any other information obtained related to this study will be confidential. None of the questions require participants to provide information that could lead to their personal identification. Interviews on audiotapes will be put on transcripts and an identification number will be assigned, so no personally identifying information can be linked to that data. Although direct quotes will be used, they will not be identified with any specific individual or organization. Information maintained and reported will be stripped of identifying features and represented anonymously. We will keep all interviews and analysis in a locked cabinet and/or secured server only accessible by the investigator. Any names and identifying information will be removed and aggregated data will be reported in papers and presentations.

Voluntary
Your participation in this research is voluntary. You may refuse to be observed or terminate the observation at any time. Your decision to participate, decline or withdraw from participation will have no impact on your present or future relations with the Fire Academy and the University of Illinois at Urbana-Champaign in any way.

Risks and Benefits
There are no known risks from participation in this study beyond those that exist in normal daily life. Still, as this study investigates the work process and information practice, you may feel uncomfortable letting your work being observed.

Although there may not be immediate direct benefits to you as a participant, you will be providing valuable information about your information practices and information-seeking behavior. You may benefit from this project by becoming more aware of your own information practices and how these practices impact your training and teaching. Moreover, there is the potential to aid in the development of information systems and programs that can enhance library programs and information services tailored to your information use environment.

Who to Contact
If you have any questions about the project, please contact the project staff at:

Lian Ruan
GSLIS Ph.D. Student
University of Illinois at Urbana-Champaign
Champaign, IL 61820
Tel. 217 265-6107
Fax: 217 244-6790
E-mail: lruan@illinois.edu

I HAVE READ AND UNDERSTOOD THE INFORMATION ABOVE AND CONFIRM THE FOLLOWING STATEMENTS ON VOLUNTARINESS

I understand that my participation is entirely voluntary.
I understand that I may refuse to participate or may discontinue participation at any time during the project without penalty.
I understand that I may skip the observation.
I grant the investigator permission to use the observation for Lian Ruan's dissertation.
I grant the investigator permission to use the observation for presentations at professional meetings and papers published by professional journals.

Do you as leading instructor give Lian Ruan permission to observe your class?
Yes ______ No ____

Your signature indicates that you have read and understood the information provided above and have decided to participate. You may withdraw at any time after signing this form.

____
Print Your Name

____
Signature of Participant Date

Please keep the attached copy of this consent form for your records acknowledging that you have signed the consent form.

If you have any questions about your rights as a participant in this study, please contact the University of Illinois Institutional Review Board at 217 333-2670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

APPENDIX L

THE FIRE ACADEMY'S CURRICULUM DEVELOPMENT PROCEDURE FOR NEW COURSES

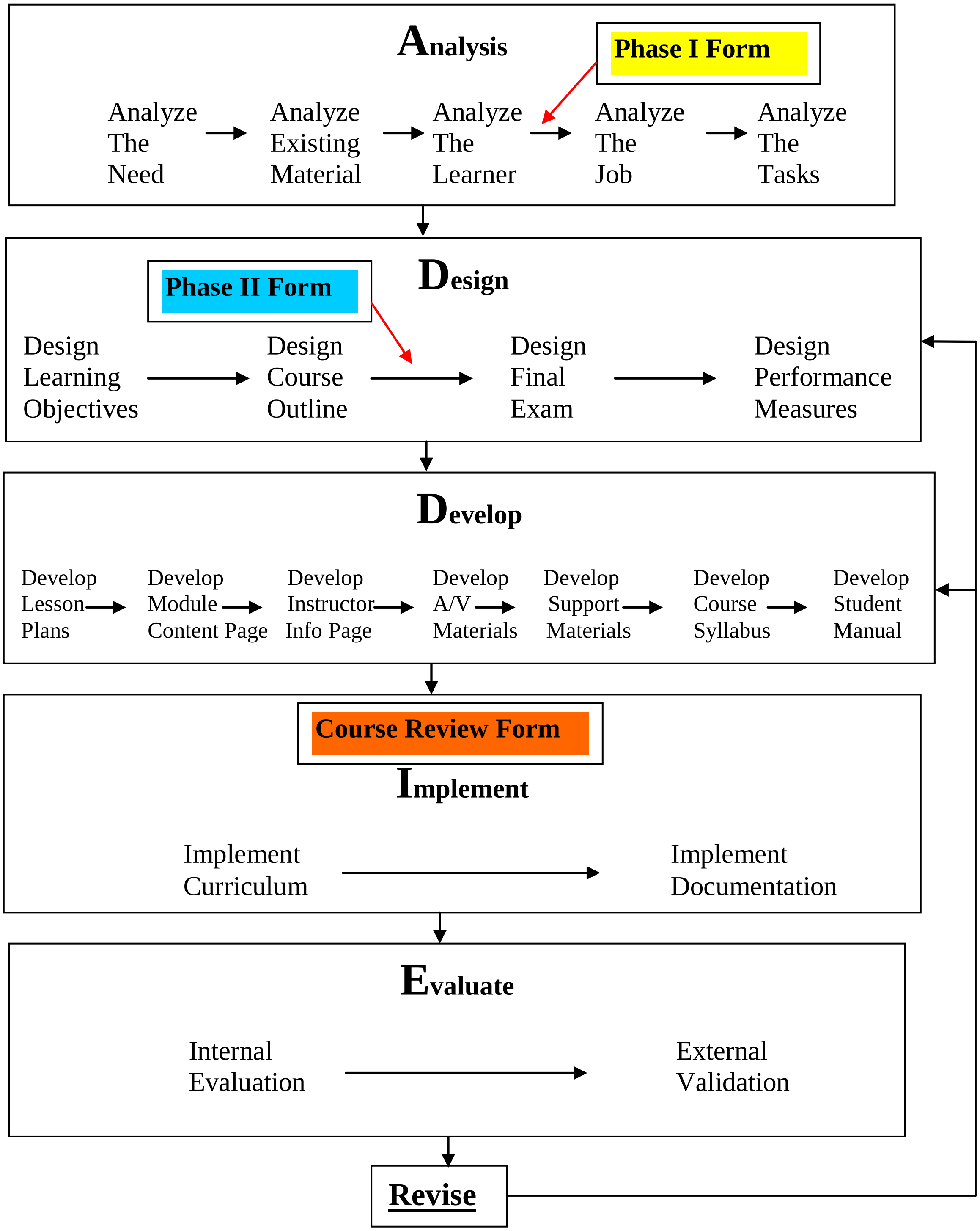
According to the Curriculum Support Specialist, the Fire Academy created the following procedure for new courses to develop the highest quality curriculum, centralize and document the instructional design process, and help instructors.

Instructor course designer(s) will:

1) Develop an idea for a course
2) Complete the "New Course Proposal Phase I" form
3) Complete the "New Course Proposal Phase II" form
4) Produce all course materials
5) Submit course materials to curriculum support for the Deputy Director's approval
6) Upon approval staff will add the course title into the shared drive
7) Conduct pilot course
8) Conduct Train-the-Trainer Program(s) if needed
9) Deliver the new course

APPENDIX M

THE FIRE ACADEMY'S INSTRUCTIONAL DESIGN PROCESS BY THE CURRICULUM SUPPORT SPECIALIST



APPENDIX N

SPECIFIC COURSES TAUGHT AND WRITTEN BY THE FIELD STAFF INSTRUCTOR PARTICIPANTS

Predominant Subject Focus	Course Taught	Course Written
Structural Collapse	. Structural Collapse Rescue	. Certificate Firefighter . Fire Officer I&II . Structural Collapse
Firefighting	. Recruits School . Smoke Diver School . Pump-up Reader School . FAST School . Rural Firefighting . House Burns	. Navistar Program for International Truck and Engine Company . Recruit School . FAST School . Smoke Diver School . Pump-up operators School . FAE . Arson . Industrial Firefighter . First Aid Rescue I+II
Firefighting	. Essentials Programs: Essentials I Essential II . Pump Operations . SCBA Training . Industrial Programs . Hazmat Program Level I, Level II . Technical Rescue . Vertical Rescue . Confined Space Training . Trench Rescue . Awareness Level for Confined Space . Fire Service Instructor I . Fire Investigation . Fireground Management for . Small Career and Rural Fire Departments . Fireground Communications	. Fireground Management for Small Career and Rural Fire Departments . Fireground Operations and Communications . Firefighting Essentials I . Firefighting Essentials II . Fire Behavior . Hazmat Operations and Technician . Incident Command . Response Management for the Local Response
Oil and Gas Programs	. LPG, Firefighting, Oil Well . Rescue . Confined Space Rescue . Trench Rescue (every now and then) . Vertical Rescue (on campus) . Industrial Program for firefighting, fire brigade training . Weekend Firefighting Schools . Tower Rescue . Communication Tower Rescue	. LPG . LPG Advanced

Appendix N (cont.)

Predominant Subject Focus	**Course Taught**	**Course Written**
Rescue	. Auto Extrication (does the most)	. It Crashed in Your Backyard . Essentials of Firefighting
Firefighting	. Rescue (does the most) . Rope Tactics and Operations . Trench Tactics and Operations . Vehicle Machine Operations and Technicians . Cornerstone program	. Vehicle / Machinery Operations . Vehicle / Machinery Technician
EMT	. EMT-B . ICS for EMS, Medical Specialist	. Women in the Fire Service about Mass Casualty Triage . RIT Under fire . EMT-B . ICS for EMS, Medical Specialist
Firefighting	. Ethanol Awareness . Down and Dirty Hydraulics	. Aircraft Awareness & First Response
Ethanol Awareness	. Basic Pumps . Engine Company Operations . Down and Dirty Engine Company Operations . LPG training . Light and Fight Operations . Fire College . Coordinated Fire Attack . EMS (not for the Fire Academy) Courses Taught at Community Colleges: . Building Construction for the Fire Service . Instructor I, Advanced Techniques and Strategy I . Introduction to the Fire Service	. Firefighting
Live Burns Officers Program	. Explorer Cadet Fire School . Fire College . Tower Burn . Officer. Leadership	. Engine Company Operations . Engine Company Ops for Commercial Buildings . Reducing Line-of-duty Deaths: the Role of Rehab
Firefighting	. Tactics and Strategy II (fire officers on multi-unit operations & direct figure operations, high-rise operations) (40 hours) . Fire Officer School, and Command School . Firefighter II Academy	. Firefighter I & II Academy . Fireground Officer & Command . R.I.T Operations . Saving Our Own . Many classes in Cornerstone

Appendix N (cont.)

Predominant Subject Focus	**Course Taught**	**Course Written**
Firefighting	. Fire Officer [Program] . Fireground Officer School . Management . Tactics . Instructor I . Command Officer School . Smoke Tactics . Fireground Officer School . Fireground Command Officer School . Strategies and Tactics . First Company Officer . Basic Company Officer . Management I, II, III, IV	. All courses in Fire Officer . Rope/Trench (Office of Domestic Preparedness)
Specialized Rescue Programs	. Confined Space . Rope Rescue . Trench Rescue Operations . Firefighter I . Firefighter II . Instructor I . Instructor II	. Thermal Imaging . Fire Officer I & II . Trench Operations/Technician . Confined Space Technician
Industrial Firefighting	. Industrial Firefighting . Confined Space Operations . Confined Space Technicians . Rope Rescue Operations . Rope Rescue Technicians . Trench Rescue Operations . Trench Rescue Technician	. Confined Space Technician
Command and General Staff	. Red Cross First Aid . Unified Command . Command and General Staff . ICS (Incident Command System) 300 and ICS 400 series . Anhydrous Ammonia . Hazardous Material Awareness	. Incident Command classes . Command & General Staff
Hazmat Program	. Hazmat Awareness . Hazmat Operations . Hazmat Technician . Firefighter II, Module A, B and C . Essentials . House Burns . Cornerstone Firefighting	. Engine Company Operations . Instructor I & II . All cornerstone topics . Hazmat Awareness . Hazmat Operations . Hazmat Technician A & B

Appendix N (cont.)

Predominant Subject Focus	Course Taught	Course Written
Firefighting	. Firefighter II . Fire Tactics (Fire College): RIT Operations . Fire Tactics (Fire College): Coordinated Fire Attack . Saving Our Own . Basic Company Officer . Cornerstone Firefighting	. All Cornerstone classes
Firefighting	. Photography for the Arson Program	. Lots of Fireground Management classes . Management III & IV
Homeland Security	. Breathing Apparatus for Firefighter	. Homeland security
Firefighting	. SCBA Repairs . Fire Academy	. Respiratory Protection Programs
Hazmat Programs	. Hazmat Awareness . Hazmat Operations . Hazmat Technician A &B . Hazmaterials Incident Management	. SWMD: Hazmat Awareness . SWMD: Hazmat Operations . SWMD: Hazmat Technicians B
Firefighting	. Fire Essentials 1 . Fire Essentials 2 . Fire Essentials 3 . Hazardous Materials Operations for Industry . Hazardous Materials Technician for Industry . Forest Fire Prevention . Fire Investigation . Rope Rescue	. FAST (Firefighting) . Many classes in Cornerstone . ICS (Hazmat) . Hazmat EMS . Hazmat Technician A & B . SWMD: Confined Space Operations & Technician . SWMD: Rope Rescue Operations & Technician . ICS (Industry) . Trench (Industry) . Hazmat (Industry) . Firefighting (Industry) . Rescue (Industry)
Fire Prevention	. Fire Inspection . Fire Investigation . Public Education	. Fire Prevention Principles . Origin & Cause Awareness . Investigation 1, 2 &3 . Inspector 1&2
Firefighting	. Firefighter Academy . SCBA . Weekend Burns with fire departments . Contract classes with fire departments . Management	. Thermal Imaging

Appendix N (cont.)

Predominant Subject Focus	**Course Taught**	**Course Written**
Firefighting	. Fire Academy . Industrial classes . Hazardous materials . Online courses	. Firefighter II Online . Ethanol Awareness . Down & Dirty DVD&CD . Fire Service Vehicle Online . Nicor Gas Emergencies . Hazmat Awareness Online . Technical Rescue Awareness Online . Origin & Cause Awareness Online
Firefighting	. Essentials of Firefighting . Fire Officer	. Firefighting
Firefighting	. Fire Academy . Rapid Intervention Teams . Engine Company Operations . Truck Company Operations . Foam	. Rapid Intervention Teams . Truck Company Operations
Firefighting	. Officer Fireground School . FAST School, High Rise Training . Tactics and Strategy . High Rise . Instructor I . Instructor II . Fire College . Winter Fire School . Fire Academy . Duty, Pride, Tradition . Chicago Fire Academy	. Duty Pride Tradition Mayday . Leadership

Note: Data for Appendix N were generated from instructor participants' interviews and profiles. The appendix indicates that instructor participants tend to seek opportunities to "branch out" their knowledge base and to be exposed to as many different topics as they could, even though they have their own predominant subject focus.

APPENDIX O

FORMAL SOURCES OF INFORMATION IN PRINT USED BY FIELD STAFF INSTRUCTOR PARTICIPANTS

Type of Print Source	**Internal /External Document**	**Sample Fire Academy Program/Course**
References		
Standard		
**National Fire Protection Association (NFPA)* — see note	External	Aircraft Rescue, Confined Space Rescue Technician, Firefighting, Fire Investigation, Hazmat, Industrial Programs, LP, Trench Rescue, Technical Rescue
American Society for Testing and Materials (ASTM)	External	Hazardous Materials Operations Technician for Industry
Department of Transportation (DOT)	External	Respiratory Protection Programs, Emergency Medical Service
State Department of Labor	External	Respiratory Protection Programs
Law & Regulation		
State Law	External	Trench Rescue
Code of Federal Regulations	External	Hazardous Materials Operations Technician for Industry
Legal Case Laws	External	Fire Investigation
Objectives		
Occupational Safety and Health Administration (OSHA)	External	Confined Space Rescue Technician, Hazmat, Hazardous Materials Operations Technician for Industry, LP, Rescue, Respiratory Protection Programs
Department of Homeland Security (DHS)	External	Hazmat, Rescue, Confined Space Rescue Technician, Homeland Security
Federal Emergency Management Agency	External	Confined Space Rescue Technician, Emergency Medical Service, Safety Officer, Fire Investigation
National Fire Academy	External	Command and General Staff, Fire Program Management for Small Career Volunteer Fire Departments, Homeland Security
Emergency Management Institute	External	Homeland Security
Office of State Fire Marshal (OSFM)	External	Auto Rescue, Fire Investigation, Firefighting, Hazmat, Technical Rescue
Fire Academy	Internal	Firefighting, Industrial Program, Technical Rescue

Appendix O (cont.)

Type of Print Source	Internal /External Document	Sample Fire Academy Program/Course
Guides		
Emergency Response Guide	External	Hazmat
National Propane Gas Association	External	LP
Field Operations Guides	Internal	Trench Rescue
Manufacturer's Guideline	External	Trench Rescue, Technical Rescue
Literature		
Book		Airport Operations for Structural Firefighters, Firefighting, Technical Rescue, Hazmat
**Textbook*	External	Fire Officer, Technical Rescue, Fire Academy, Fire Investigation, Firefighting
**Trade Journal (Articles)*	External	Emergency Medical Service, Firefighting, Fire Investigation, Hazmat, Unified Command System, Trench Rescue
Workbook	External	Emergency Medical Service
Student book	External	Emergency Medical Service
Manual		
Instructor Manual	Internal and/or External	Emergency Medical Service, Firefighting, Hazmat, Trench Rescue, LP
Student Manual	Internal and/or External	Emergency Medical Service, Unified Command, Trench Rescue
Technical Manual	Internal and/or External	Firefighting
International Fire Service Training Association (IFSTA)	External	Firefighting
Guide		
Instructor Guide	External	Emergency Medical Service
Study Guide	External	Firefighting
Newspapers	External	Aircraft Rescue, Firefighting
Case studies/Incidents	External/Internal	Firefighting, Hazmat, Trench Rescue, Unified Command
Curricula		
**Fire Academy Curricula*	Internal	Firefighting, Hazmat, Trench Rescue, Industry
**Curricula from other organizations*	External	Firefighting, Hazmat, Safety Officer, Unified Command, Women in the Fire Service about Mass Casualty Triage

Appendix O (cont.)

Type of Print Source	**Internal /External Document**	**Sample Fire Academy Program/Course**
Report		
**National Institute for Occupational Safety & Health (NIOSH) (Firefighter fatalities)*	External	Firefighting, Safety Officer,
International Association of Fire Chiefs (IAFC) (Near Miss Reports for incidents)	External	Firefighting
International Association of Firefighters (IAFF)	External	Firefighting
Policy		
Standard Operation Procedure (SOP)	Internal and/or External	Firefighting
Standard Operation Guide (SOG)	Internal and/or External	Firefighting
Fire Academy Procedure	Internal	Firefighting
Gray Literature		
Lumberyard brochure	External	Structural Collapse Rescue

Note: *means most frequently mentioned and used by the interview participants.

APPENDIX P

RANK THE MOST IMPORTANT SOURCE AMONG EXPERIENCE, PEOPLE AND PERSONAL COLLECTION

Top Rank	Program Subject	Sample Quotation
Experience		
15	Firefighting	My experience as the highest comes first [RH_1_30_2009].
	Firefighting	I would say one is experience [CAH_2_17_2009].
	Firefighting	Experience, and then people [JRs_2_18_2009].
	Firefighting	Experience [JL_2_23_2009].
	Firefighting	Experience because it's learned the hard way, it's learned some hard lessons [MM_2_26_2009].
	Firefighting	The experience plays a really, really big role in what we have to teach in the fire service because there have been so many things learned by those individuals that go beyond the core of the text [RAV_3_10_2009].
	Firefighting	Experience because all the reference materials in the world is somebody else's work until I can utilize that and make that my own. It's not as important. A person who has honestly learned something the hard way through his experience is very passionate about it. The experience has to be the most important [BF_3_11_2009].
	Firefighting	I rank my personal experience the most important. That's what works for me being out there. You go on many calls. You can learn a lot from the books, and from other resources, now with DVDs, and whatever you have. There's a lot to learn but that's only one-sided, but the personal experience is the part that you have already done it so you know it does work or doesn't work though [JS_3_17_2009].
	Firefighting	I would like to say experience. There is nothing you can do to replace them whether the experience is good or bad. You file that away, and you definitely get them on a greater comfort level, no matter what you are doing, whether you are instructing, or you are actually in a real fire [HG_3_2_2009].
	Firefighting	I would rely on experience because I have yet to see a book put out a fire, I have yet to see a computer put out fire, and I have seen young firefighters burn out the first five minutes of climbing [GF_2_13_2009].
	Hazardous materials	The most important would be people's experiences [CD_3_5_2009].
	Hazardous materials	You have still gotta go with your gut and your personal experience and that of your crew [RP_2_19_2009].
	Emergency Medical Service	Either my experience or other instructors' street experiences [SD_1_27_2009].
	Homeland security	Start with yourself, start with the experience, that's the most important [LD_2_17_2009].

Appendix P (cont.)

Top Rank	Program Subject	Sample Quotation
Experience		
	Technical rescue	Experience has got to be number one. You have real world experience. You got those experiences internalized. Then you can share [WBM_2_10_2009].
Experience & People		
6	LP	Experience and people are related, are both important. They got to be related. They are equally important [MC_2_12_2009].
	Firefighting	I had people I like to call that they had experience themselves. Relying on experienced people would probably rank No. 1 [EE_2_25_2009].
	Firefighting	The people [JWR_2_25_2009].
	Firefighting	People who are knowledgeable and experienced in that skill [TS_3_4_2009].
	Firefighting	People with experience and the background who was already trial and error teaching it [GG_3_10_2009].
	Firefighting	People and experience go hand in hand [LL_2_18_2009].
Personal Collection		
4	Technical rescue	Personal collection first [JD_2_5_2009].
	Firefighting	The first one is personal collection [RL_2_11_2009].
	Firefighting	Personal collection [RSS_2_19_2009].
	Firefighting	My personal collection is probably the most important [EB_3_10_2009].

APPENDIX Q

CLASSES BY FIELD STAFF INSTRUCTOR PARTICIPANTS IN TEAM TEACHING AND WRITING

Class Title Taught by Team	**Class Title Written by Team**
Auto Rescue	Auto Rescue
Basic Company Officers	Basic Company Officers
Confined Space Technician	Confined Space Technician
Cornerstone Program	Cornerstone Program
Duty, Pride and Tradition	Duty, Pride and Tradition
Fire Academy	Fire Academy
Fire College	Fire College
Fireground Officer Commander School	Fireground Officer Commander School
Fire Investigation	Fire Investigation
Fire Prevention Officer	Fire Prevention Officer
Firefighting	Firefighting
Fireground Officer Commander School	Fireground Officer Commander School
First Company Officer	First Company Officer
General & Command Staff	General & Command Staff
Hazmat	Hazmat
Industry	Industry
It Crashed in Your Backyard	It Crashed in Your Backyard
LP	LP
Management I, II, III, IV	Management I, II, III, IV
Mass Casualty Triage	Mass Casualty Triage
Saving Our Own	Saving Our Own
Strategies and Tactics I	Strategies and Tactics I
Tactics and Strategy	Tactics and Strategy
Trench Rescue Operations	Trench Rescue Operations
Trench Rescue Technician	Trench Rescue Technician
Unified Command	Unified Command

Note: Appendix Q indicates that the instructor participants who worked in the team writing project(s) tended to stay in the same team and teach the same class.

APPENDIX R

INFORMATION INTEGRATION OF MULTIPLE SOURCES IN CURRICULUM DEVELOPMENT

Fire Academy Program/Class	**Multiple Sources**
Airport Operations for Structural Firefighters	. Fire department training officers . Tour of the local airport . Picture (Photo) . Books . Internet . IFSTA manual (nationally-known materials and recognized source) . Aircraft manufacturers (specific aircraft) and emergency procedures
Auto Extrication	. Private library (personal collection) . Web/Internet . Phone calls to experts . Library . Manufacturers
Basic Company Officer	. Personal experience and feel . Older firefighters' experiences . Other sources, other people . Movies, i.e., home-made videos . Pictures (Photos) . Conversations with other experienced firefighters . Tricks of the trade . Books, magazines and articles, Fire Engineering magazine
Command and General Staff/ Homeland Security	. National Fire Academy (NFA)'s student manual . NFA PowerPoint . NFA curriculum . Experienced out-of-state NFA consultants. Experienced out-of-state NFA instructors and leaders from New York, California, Montana, Florida, Texas . Modification of the NFA curriculum . Local and state enhancements from personal experiences of different instructors . State Emergency Management Agency . Field operations guides for reference, from the Coast Guard and Mobil Oil company . Fire Scope's main reference material for incidents in the wildland . Personal experience: 60 classes and almost 35 years of being a firefighter . Learning from other instructors during classes. . Library . Raw stories to help students relate . Hazards and Incident Management Team Conference . Internet . DVDs . Books . Articles, magazines . Video clips from Internet . Video from other classes . Clips from movies and TV shows . YouTube . NFPA manuals - standards . PowerPoint

Appendix R (cont.)

Fire Academy Program/Class	Multiple Sources
Command and General Staff/ Homeland Security	. Course evaluation . Instructor feedback
Company Officer School	. Years of experience . No curriculum but outlines . Hands-on experience . Self-study and research . Book reading . Louis Grandet's Building Construction class
Confined Space Rescue	. Class notes . Fire academy and all fire classes . Equipment specifications and safety parameters . Online . Magazines . Manufacture materials . Laws and regulations . National Fire Protection Association (NFPA) standards . National Incident Management System . Objectives . Occupational Safety and Health Administration (OSHA) . Office of State Fire Marshal (OSFM) . Other classes . PowerPoint . Real response information . Shared drive . Vendors (Equipment modification) . Different images, streaming video clip, or shots . Transactive memory system (4-person team. Different expertise and "skill sets" to complement each other)
Cornerstone Program	. Shared Drive . Group members' feedback . OSFM Firefighter II and III objectives . Lesson plan . Handouts . Movies . PowerPoint
Duty, Pride and Tradition	. Books . Impact statement, impact stories . Internet . Library . Personal experience, military & fire experience . Father's experience and influence . Personal history . Personal thoughts – hot and cold topics . Reference books . Heroes: John Norman, Tom Brennan . Books and articles by John Norman and Tom Brennan . Network (National Fire Academy, students) . Education (books from college – lifetime book collector) . Other people

Appendix R (cont.)

Fire Academy Program/Class	**Multiple Sources**
Duty, Pride and Tradition	. Videos . IFSTA books . Military history, military examples of leadership . Military books . Military reunions . Stories
Emergency Medical Technician (EMT)	. CDs . First Aid (Bradley, 10th edition) . Workbook . Student book . Instructor Guide . Book chapter . Department of Transportation Guidelines . Federal Emergency Management Agency Urban Search & Rescue Medical Specialist Guide . Magazine and articles ("Rescue," "JEMS," "FireHouse") . Internet. Websites . People
Fire Investigation	. Internet . Sources from government agencies: National Fire Academy, Federal Emergency Management Agency, Bureau of Alcohol, Tobacco, Firearms and Explosives . Personal files (books, texts and past programs, print and e-copy) . Team instructors
Fire Investigation and the Fire Inspection Program	. Main references (NFPA guides and standards) . Published texts . Instructor experts (public and private sectors): real world experience . Real world activities and issues . Personal files
Fire Officer Program (Management I, II, III, IV)	. Textbooks . OSFM Objectives . Trade journals or magazines . Personal experience: battalion chief, fire chief, company officer . Other people's experiences . Transactive memory system . Videos
Firefighter Academy	. Internet. Google (first thing for immediate need) . People (expert: fireman, officer, chief) . Library . Fire Academy document (Standard Operating Guideline) . Fire Academy procedure . Delmar book . Manuals . Personal background and experience level

Appendix R (cont.)

Fire Academy Program/Class	Multiple Sources
Firefighting	. Research . Library . Books . Magazines . Internet . Own personal experience . Other experienced people . Humor . Stories . Student experience . Visual images . PowerPoint . Images from Internet, books, magazines . Images taken by himself . Firefighter II or III objectives (OSFM)
Firefighting	. All types of reports on the Internet: firefighter death reports, NIOSH incident reports . Communication problems in a cockpit concerned with human errors . Books . Dissertation . Videotapes . Trade shows and journals . Fire magazines . DVDs . NFPA standards . People . Air Force instructors (outside fire service field) . Specialty (experiences and subject knowledge) . Veteran users and local expertise (specific local techniques) . Professional conferences, e.g., FDIC . Aviation and pilot training . Crew research and literature . Medical resource management . Leadership management in high stress environments . Group decision making books . Personal library
Firefighting	. Fire sites on Internet (Fire Engineering, Firehouse, National Fire Academy; online articles and information; forum) . YouTube . Penwell Publications, e.g., Fire Engineering magazine . National Fire Academy's TRADE listserv, bulletin board, website . Resources of people (fire and non-fire) . Trade shows: Vendors, equipment, education, DVDs, books, CDs, interactive multimedia, company's individual tutorials, instructional aid . Transactive memory system (four-person team)

Appendix R (cont.)

Fire Academy Program/Class	Multiple Sources
Firefighting	Developed a class "presenting information that has already been accepted": . Professional publications . Tactics and Strategy books . Articles from Fire Engineering Magazine . Websites. Internet A very specific narrow area with little written information: . Personal experience . Experience of others
Firefighting	. Experience . Internet . Personal collection . PowerPoint
Firefighting	. Internet . Small library in local fire department . Personal collection: Firehouse magazine; textbooks . Colleagues' experiences and opinions
Firefighting	. Internet (trade journals online) . Articles . Text . Trade journals . Websites . Library . Books . Textbook . Experiential knowledge . Network of people (subject matter experts) . Internet . Magazines . Videos . Personal collection . PowerPoint . Lesson plans . Materials from other classes, e.g. pamphlets . Drills (hands-on practical) out of experience
Firefighting	. Articles . Paper . Video clip on TV . Magazine (fire and non-fire) . Building in the community . Quick ride around the community . Gas station related to ethanol training
Fireground Management for Small Career and Rural Fire Departments	. National Fire Academy programs . Hazmat programs at the Fire Academy . OSHA . Video . Lots of trade journals . Personal experience and other instructors' experience on what did not work . Sparky . Slides . Transactive memory system (two-person team)

Appendix R (cont.)

Fire Academy Program/Class	Multiple Sources
Fireground Officer Management School	. Other firefighting classes, e.g., Tactics I and II . Fire Officer's Handbook . Strategies and Tactics book . Expert in structural collapse . John Norman Book . OSFM Objectives . Experience: "plug in everything we know into the program" . Internet . Lots of overheads . Lots of videos of incidents from different places . Transactive memory system (5-6 person team)
Hazardous Materials Program	. NFPA standards . OSFM objectives . OSHA regulations . Current events, trade magazines, or new books . Stories . Textbooks . Strength of instructors [experience], time, group of 10-12 instructors who assist in curriculum development . Hazmat curriculum, lots of information . Library . Personal library . Internet . Manufacturers . CAMEO (Computer-aided resources) . MS material safety datasheet . References . Magazines and trade journals . Videotapes (commercially-made)
Hazardous Materials Program	At home or at the Fire Academy: . Internet, electronic media . Libraries . Expert . Instructor's manual . Video clips from other instructors . News clips from other instructors . OSHA standards, NFPA standards, OSFM standards . Emergency Response Guide . Changes of tools and devices In the Emergency Scene: . Personal experience . Coworkers' experience . Education
Hazardous Materials Operations Technician for Industry	. Hazmat 40 hour Operations Technician I. . 29 Code of Federal Regulations 1910 1.20 Section Q . NFPA 472 . OSHA . OSFM objectives . Personal practical experience in hazmat and fire inspection . Practical drills in practical scenarios . Transactive memory system

Appendix R (cont.)

Fire Academy Program/Class	**Multiple Sources**
Industrial Confined Space	. OSHA standards . 29 Code of Federal Regulations 1910 146 . Phone calls to OSHA to clarify standards . Personal experience and experiences of others . Objectives . Transactive memory system (3 or 4 persons team) . Industrial contact and expert: experience and actual knowledge . Contractor . CDs . Class evaluations
It Crashed in Your Backyard	. Expert (Battalion Chiefs in airport) . International guard . Airport and aircraft courses from the military, the Air Force, and the Marines . Newspaper . Other curricula (e.g., Airport courses in the military, Air Force, Marines) . Outside contacts . NFPA standards . Research findings from libraries . Tools . Manufacturers . IFSTA books . CDs in the Library . Newspapers . Classes on foam, rescue and rescue tools . Transactive memory system
Leadership	. Trade journals . Books . Contacts in fire service, friends, people that are very good in this area . Survey of fire departments nationwide through listserv of the Fire Academy, National Fire Academy . Fairly extensive private library: books, policies, procedures of fire department, training materials from other fire departments . National Fire Academy Library . Internet . Best practice models
LP (Liquefied Petroleum)	. Modification of previous programs . Expert (internal and external) . Manuals . National Propane Gas Association's lectures . National Transportation Safety Board . OSHA stuff . NFPA standards . Real world aspect for hands-on . Experienced team instructors . Transactive memory system (3-person team) . Student feedback . Industrial magazines in the library . Industrial sites

Appendix R (cont.)

Fire Academy Program/Class	Multiple Sources
LP (Liquefied Petroleum)	. Firefighting books . Fire Essential's magazines and books . Fire brigade . LP folder on shared drive: PowerPoint . E-mail . Videotapes on hazmat and petroleum based product, propane, propylene butane from Film Group, real incidents . Videos: Hazmat and fire investigation; sent-in tapes . Internet . Different Websites: Minnesota, Indiana website . Shared drive . YouTube . Fire Investigation class . Incidents to help update curriculum . Books . Photos sent-in by other people . Calls to instructors . Big organizations, e.g., Boots and Coots . Library
Thermal Imaging Camera	. Camera company . Course outline . Expert (internal and external) by phone and e-mail . Experience (personal and group members') . Internet . Library resources, publications . Camera company . Transactive memory system (group expert knowledge) . PowerPoint . Video clips . Trade magazines . Reports . Standards, documents from OSHA
Online Firefighting	. CDs . Videos and scripts . DVDs . Expert (internal and external: Deputy Director for Academic Affairs; Engineers) . Resources of the instructors (program director, deputy director, field staff instructors, subject expertise) . Library (for specific problem) . NFPA documents . NIOSH documents . National Fire Academy reports . Manufacturers . Subject matter experts for particular areas, e.g. ethanol industry experts and outside agencies . Picture (Photo) . Study guide . Textbooks (specific. John Norman's book on tactics, Chief Banigan and Chief Down's books)

Appendix R (cont.)

Fire Academy Program/Class	**Multiple Sources**
Online Firefighting	. Weblog (web articles), web, Google . Animation . Audio . Keyboard chat . Interactive training modules
Online Ethanol Class	. Personal experience . CDs . Study guides . Videos . Pictures . Textbooks . Library . Articles and Magazines . Internet . Subject matter expert (internal and external) by email or phone . Resources of the instructors, program director, deputy director (people), field staff instructors -- subject expertise . PowerPoint . Library . Industrial expert and outside agencies
Online Technical Rescue	. PowerPoint . Teaching outlines . Pictures . Digital images or graphics . Audio . Flash animations with scripts . Streaming flash presentations . Diagrams . Flowcharts with pictures
Reading Smoke	. Previous classes . Experts, friends, mentors, other people . Student feedback and questions . Research . Vincent Dunn’s work on flashover . Internet . Books . Library . Videos . Personal collection of videos . CDs . DVDs . Pictures
Residential Size up Class	. Old house websites, floor plans, patterns of two-bedroom bungalows . Old house living and renovation experience. . Architecture books . eBay . Public library . Feedback from wife and close friends

Appendix R (cont.)

Fire Academy Program/Class	**Multiple Sources**
Respiratory Protection Programs	. OSHA standards . Department of Transportation standards . Illinois Department of Transportation standards . Personal experience . Research for supplementary information . Outline . PowerPoint presentations . Pictures (Photos) . Fire Academy Curriculum Support Specialist . Fire Academy training package
Safety Officer Program	. National Fire Academy program . Current safety officer class . Transactive memory system (2-person team) . Expert (internal: Curriculum Support Specialist, Deputy Director for Academic Affairs) . Library . Internet . Histories of national incidents: Hurricane Katrina, 9/11, major worldwide events . Incident reports . Lots of references in the library . Videos . Books . News . News clippings . News information . Folks who had participated in some of these incidents
Saving Our Own	. Actual hands-on physical techniques . Articles . Books . Firefighter fatalities, e.g. John Nance (Columbus, Ohio) . Group of friends' information sharing and exchange by phone, fax and mail . Experience (personal, pool of group members') . Feedback from students and actual responses . Fire and non-fire magazines (e.g., *Fire Engineering* magazine, *Firehouse* magazine, *Fire Command* magazine, and Columbus, Ohio city magazine, a non-fire journal) . Online NIOSH reports . Personal loss . NIOSH Reports . Transactive memory system (group expert knowledge)
Structural Collapse	. Personal experience and other instructors' experiences . Research findings with Underwriter Laboratories . Construction features, fire behavior, building construction . Trade journals . Building trades . Brochures at lumberyard . Personal collection of books . Library . Google

Appendix R (cont.)

Fire Academy Program/Class	**Multiple Sources**
Trench Rescue	. Objectives . Manufacturers' Tabulated data . Pictures (Photos) . Teaching experience . Prescribed textbooks . Course syllabi . NFPA standards . Law and standards . Worst case scenarios . Experience from different instructors and students . Feedback from third parties . Transactive memory system
Unified Command	. Historical perspective . Case histories & case studies . Major incidents . Specific information from the state . Personal experience . Personal collection . Research . Transactive memory system

APPENDIX S

RPD MODEL IN FIELD STAFF INSTRUCTORS' OWN WORDS AND CONCEPTS

Program	**Instructor's Word**	**Concept**	**Heard about RPD (Y/N)**
Emergency Medical Service	When you teach EMT-B class, when you have them first assess the patient, you want them to start airway. You have to do airway first… Assessment, Airway, Breathing, Circulation. We want them to get that *habit* [SD_1_27_2009].	. Habit	N
Firefighting	That's your experience. First day you are on your job, first fire you go. You don't have any point of reference. You have never been to a fire. Now you start to build a point of reference. You go to a fire and you go to fire at basement. We know how they are going to act. We know how fire is going to act when they are in the attic. We understand how fire is going to move. We see the same similarities. We see the same things. We know what worked. We know what didn't work. So when you are here in the situation, your mind immediately tries to bring up the picture that is close to what it is, and then "Bang!" What worked, what didn't work. Let's go with what worked. It may not completely work in this situation, but it is a starting point. And then once we start, we have got a backup, and then we evaluate whether we are making progress, and then we make adjustment accordingly. What you try to do is you try to give them something that they can go back to and build that point of reference. What we hope is when he goes to that type of fire. He did hear something that will help him in that type of fire. He is going to build his own point of reference at that time, when he physically has to do that sort of stuff. Now he has some real data that he can build on. The next time he comes back, when we talk about the same scenario, he can bring his experience in it [MM_2_26_2009].	. Point of reference . Experience . Faster computer	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	I teach about the concepts [on index card], read a building, read the smoke, read the fire, then make your decisions, pick strategies and tactics. After you [students] have done that, you can do that at a fire, and then if you go to a rescue situation, you can still read the scene, the smoke or whatever complexity you are seeing, and make decisions based on what you have read. They [students] realize they have got the principles and concepts done, and they'll just adapt them [RH_1_30_2009]. I wanted to pull the answers out of those individuals [students], help them develop the ability to think, pass their fears of not knowing, and I set up developing a thing what I called "Index Card" concept. In my belief there is each person that has an index card box in their head. Inside their box are all of those cards that he developed during life [RH_1_30_2009].	. Concepts on Index Cards	N
Firefighting	You taught people how to read. One of the things I developed is when you look at the situation, read the building, read the smoke, read the fire, and then make a decision. The problem is that, you might not know their language. So in order to develop your ability to read these three things, there is something you can do. I will teach about profiling buildings. You started with simple houses and so on and develop profiles for five different things you do with a fire: ladder, lead-outs, search and rescue, ventilation, and forcible entry and exit [RH_1_30_2009].	Profile the building	N

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	That [RPD model] is how firemen pretty much act. That's why we do so much training, and training is so over repetitive that you do it over, and over, and over again because it has to be second nature like tying your shoes. There is where the experience comes in, where I have been in a fire before. I know exactly how this is, what could happen so you run as pre-plan in your head [JS_3_17_2009].	. Repetition . Second nature . Experience . Preplan	Y
Firefighting	Every [fire emergency] situation is different. You have some basic stuff, some guideline, not procedure: this is the way that has been done. There is a guideline to get you started. Because fire and everything is so fluid, hopefully there is a guideline that will help you keep going. It doesn't mean you have to stay on it. Hopefully what we taught you is enough to get you going, and keep you safe and you go from there [JRs_2_18_2009].	Guideline	Y
	I live it [RPM model] every day. I don't think it's automatic, but it becomes automatic. How do you make it automatic? Everything, use that example, these 13 points. For me, I remember earlier in my career, driving down the road, or sitting at home on the couch, or sitting by my desk and writing down 13 components and making flash. I review those over, over and over again. And, BOOM, clicking that often in my mind to make sure I had it [CAH_2_17_2009].	. 13 points . Automatic	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	I'll go back to my experience, and things learned on the street. Numerous times, I can remember, decision-making based on thing that happened before. There was a time, afterwards, someone said, "Why did you do that? How did you know that?" And I said, "I have seen it happen before." So that sort of help you, keep it in your memory banks. I think your experience is the biggest thing. The main thing is experience, have it experienced before, have a vision, have the slide tray in your head clicking, you know, bring back memories, pictures [EE_2_25_2009].	. Experience	Y
Firefighting	We are doing a company officer class. OK, here's a fire, we are going to give you twenty minutes to put that out with your company at work and explain it. Then you give them mental challenge, and you help them fine tune their decisions, fine tune what they want to do. I find that rewarding especially as an instructor in the fire service. Prepare them [students], make them battle ready, mentally and physically [EE_2_25_2009]. My desire lies in wanting to be absolutely the best firefighter you can possibly be. You are mentally prepared. You know your equipment; you know your people; you can communicate with hand signals practically because you are that well-trained. So my desire to train is usually based on wanting to be very sharp, very prepared [JL_2_23_2009].	Mental challenge	Y
Firefighting	For the hands-on part, you have to go out and do it repeatedly. Somebody hates redundancy, but without redundancy, you can't develop anything [RL_2_11_2009].	Redundancy	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	The rolodex starts clicking in the brain and it is like a computer file. It goes back to something experience that seems familiar that I dealt before. That's how I do it. Yes, anything we do, anything we encounter, as a fireman, goes back to our experience. Our experience means in our brain we think of another time, and sometimes we don't even think about. It's instant, it happens subconsciously. Our super computer brain takes us back to a file that we dealt with something similar before, either it works or it did not work [LL_2_18_2009]. In our Instructor I and II program, we talked about the Recency Model and Law of Repetition. That does the same thing. We went to a very serious fire that could have gone either way, losing the house or putting the fire out. We got seen first. Everything just clicked. We went to work just like from point A to point C. Everything went well. We even did not talk to each other, the whole time we fought this fire. It just happens. It's instant. This is from recognition. That is from experience. That's from training. That's being a student where those things just kick in. They have to embrace it, then they have to go, you know, the recognition part, the repetition, recency. They got to practice. They got to train [LL_2_18_2009].	. Rolodex – computer file . Experience . Super computer brain . Recency . Repetition . Instant decision-making . Recognition . Experience . Training	Y
Firefighting	We always tried to get something more hands-on and practical. And if you could simulate things, the better. We knew long ago that you couldn't teach firefighting without putting people in fires. We do a good job of showing them the environment and how to beat it [JWR_2_25_2009].	Know the dangerous environment and automatic response	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	The more realistic the training, the more effective the experience in the real world would be. So you try to make physical experience as real thing as possible. The [training] buildings is on fire, and [we] send people into it in a control manner. That is as close as you can get to the fire. Real heat and real smoke. [In training], we create the environment and the situation [TS_3_4_2009].	Training in simulated and controlled environment	Y
Firefighting	What I normally try to do with the students is to prepare them to gain for that first five to ten minutes of the incidents no matter what I am instructing. Give them all the critical information that they are going to need, and then normally comes down into repetition [HG_3_2_2009].	. Critical information . Repetition	Y
Firefighting	If you have the experience, you can narrow down options, but you do it in smaller windows, then you know that there are a number of different ways you can handle this with a successful outcome. But by your experience you know how to narrow it down more quickly. You know there are just so many different things that can affect the outcome [GF_2_13_2009].	. Experience . Variables	Y
Firefighting	First, I evaluate everything I do. You try to know things ahead of time. Know that stuff because you have to apply it when you get there. In recent years, I want to figure out a pattern [of using hose] how I do things which I think works better than other ones and share it with people. Even some small things, you have to practice it, otherwise you might just ruin it [JL_2_23_2009].	. Know things ahead of time . Practice	Y
Firefighting	There are four tactics that will work. What you need to do as you are growing your experience level, you need to build a toolbox that has those four tactics in it. And then you need to know in this particular situation, I'm going to open up my toolbox. I'm going to pull out this tactic and I'm going to apply [CAH_2_17_2009].	Toolbox	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Firefighting	We learned to value repetition practice. It paid off. Practice, practice, practice, practice. They give options until the student found one that seems to fit him or her [JWR_2_25_2009].	. Repetition practice	Y
Online Firefighting	I think over course period of time, as they took the study, once found that when people react, they react the same way through some consensus to it that is very effective. That goes back to the experience. You have used that experience in your knowledge that you gained over a period of time and you emphasize those points so you would hope to stick out to teach them and ingrain those in the person so he reacts in a safe and proper manner when in an emergency scene. Those are what I called again the critical content theory [RAV_3_10_2009].	. Experience . Critical content theory	Y
Hazmat	You have limited with time [at emergency scene]. You have to make decision[s] in a quickly and timely manner. There is lots of information to process. I think you flip through your brain, and you find similar, maybe it's not exact, but similar experience, similar training you have been to. That is recreating what you look at and that's the way you go with [CD_3_5_2009].	Flip through brain to find similar experience and training	Y
Hazmat	We [Hazmat] basically respond in five modes. It progresses through five different stages. And basically we start [to] isolate so you get people back, and isolate the area; identify the product is identify the products; notify--make proper notification; mitigate the situation, and terminate what you do in the end. What I try to tell our students is, if you can keep those five things in your back of your mind, you should work out just fine [CD_3_5_2009].	. Five modes	Y

Appendix S (cont.)

Program	**Instructor's Word**	**Concept**	**Heard about RPD (Y/N)**
Hazmat	You don't know what happened until it has really happened. I consciously think of like that…We don't know what would happen. But if I have done this enough times, or somebody has told me, I have read about it, I have seen it, or I have heard it, all those experiences came at that moment. You have been in the circumstances enough times. You just know [RP_2_19_2009].	. Experience	Y
LP	I look to see people [students] who truly just understand what the materials we are doing. You cannot test some that has chemical, understanding about what propane is. It is a big deal. They [students] have to have [a] different mindset, how to evaluate that, something hard to test for. It is not a test question you can write. So it is more of mental process that I truly want them to understand, and see what is in front of them, how they have to deal with it [MC_2_12_2009].	Different mindset Mental Process Learning curve	Y
Technical Rescue	There are three strategic criteria – the life safety, the incident stabilization, the property conservation and preservation. There [is] so much information going on, but again that's all come from your automatic response, being trained, being able to recognize those things, but trying to get as much information as you can, as quickly as you can. But for the most part, you have to go trial and choose, using your experience, knowledge, training and education, make as good decisions as you can make with little information you can have [WBM_2_10_2009].	Three strategic criteria	N
Unified Command System	Yes, I think somewhat you can [use RPD] because that all ties back to experience and training [LD_2_17_2009].	. Experience . Training	Y

Appendix S (cont.)

Program	Instructor's Word	Concept	Heard about RPD (Y/N)
Unified Command System/Firefighting	The RPD basically says when you are in the highest stress situation, when you have to make decision in a very short period of time, your hard drive is going to fire up, and you are going to look for the information that was there. So if we have a highly critical decision to be made, and we have a lot of experience, we have the experience, direct knowledge, to back that up. You are in the synthesis. Quite often, in very, very dangerous, very rarely occurring incidents like Hurricane Katrina, there is nothing in your hard drive since nobody's ever flooded the entire city in 36 hours before. You'd better be able to fall back on other information. We are teaching people how to think, and how to process information [BF_3_11_2009].	. Package of information in hard drive of brain . Synthesis of information	Y

AUTHOR'S BIOGRAPHY

Lian J. Ruan graduated from Peking University in 1984 with a Bachelor's degree in World History. She was admitted to the Graduate School of Peking University in 1984 and then to the Graduate School of the University of California Los Angeles (UCLA) in 1986. She completed a Master of Arts degree in African History from UCLA in 1988. She completed a Master of Science degree in Library and Information Science from the University of Illinois at Urbana-Champaign in 1990.

In 1990, Ruan founded the Illinois Fire Service Institute (IFSI) Library, University of Illinois at Urbana-Champaign, as an in-house library. The library joined inFIRE (the international network for Fire Information and Reference Exchange) in 1990 and became a member of the Lincoln Trail Libraries System (LTLS) in November 1998. The library has provided interlibrary loan services with public libraries statewide ever since. Working with the IFSI Library Advisory Committee, consisting of members from more than 16 fire and industry organizations throughout Illinois, Ruan initiated and launched the Outreach Program in 1999 to provide no-cost fire library program and information services to Illinois firefighters. She led the library's transformational changes supported by IFSI and a series of Library Services and Technology Act (LSTA) grant awards, totaling more than $250,000, funded by the Illinois State Library, a Division of the Office of Secretary of State, along with other grant efforts totaling $100,000. She has developed and maintained wide partnerships with local fire departments, public libraries, the Illinois State Library, the University of Illinois Library, and the University of Illinois Graduate School of Library and Information Science (GSLIS). The library is the only fire science dedicated library in the state, and one of the three top fire academy libraries in the nation.

Ruan serves on several professional committees, such as the Illinois State Library Advisory Committee (ISLAC) (2009-), ILLINET Network Advisory Council (INAC) (2003-), inFIRE Committee (1996-2001, 2009-), Chair for the Chinese American Librarians Association (CALA) Finance Committee (2009-), and the inFIRE Committee (2009-). With numerous publications, Ruan's research interests cover use and users of information, outreach library services, special library administration, fire information services and international librarianship. She is an adjunct faculty member in GSLIS, teaching courses in Special Library Administration and Information Access & Library Resources in the Social Sciences and Humanities in China. She is the winner of the Special Libraries Association (SLA) Diversity Leadership Development Program award and the University of Illinois Chancellor's Academic Professional Excellence award. Ruan has also served as Director of the IFSI China Programs since 2006. She has helped organize training programs, such as the Chinese Librarians Summer Program, since 2005 in cooperation with partners both in the United States and China.

Following the completion of her Ph.D., she will continue her work at the IFSI Library. The library is expanding from 700 sq. ft. to over 3,000 sq. ft., including library programs, information services, knowledge management, archives and a museum. She will carry out her research focusing on information behavior and knowledge management in the fire service, special library administration and international librarianship. She will also strengthen deeper ties between Illinois and various organizations in China.